Gains
No Vical

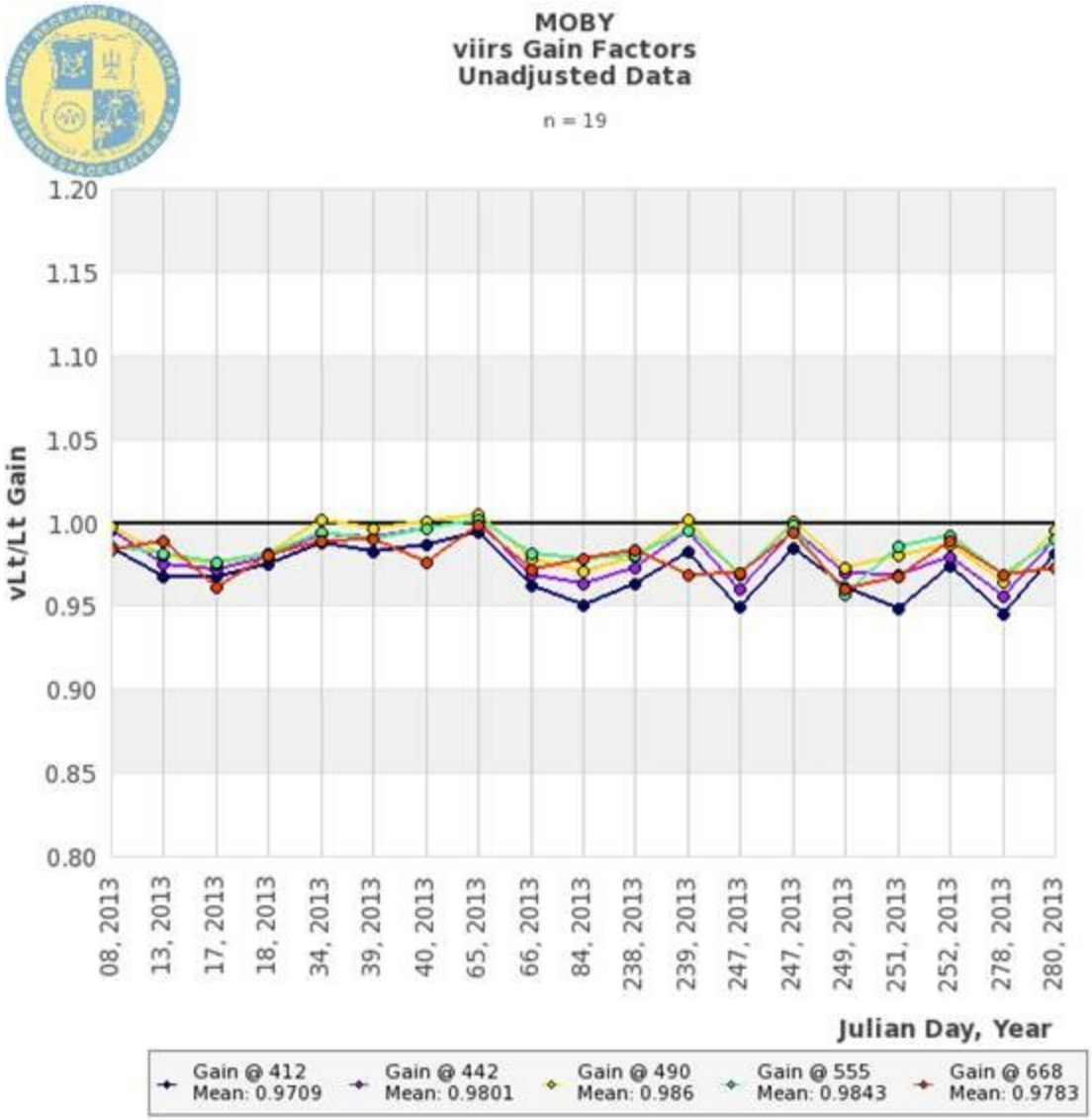



**Figure 2 shows the vLt/Lt over time using unity gains. In a perfect system in which all components are computed accurately, the original Lt and vicarious Lt should have a ratio of 1.0. Most of the ratios are below the 1.0 line suggesting the sensor without vicarious calibration is slightly high. The mean gain for the 412, 442, 490, 555, and 668 channels are 0.9709, 0.9801, 0.9860, 0.9843, and**

Gains
No Vical

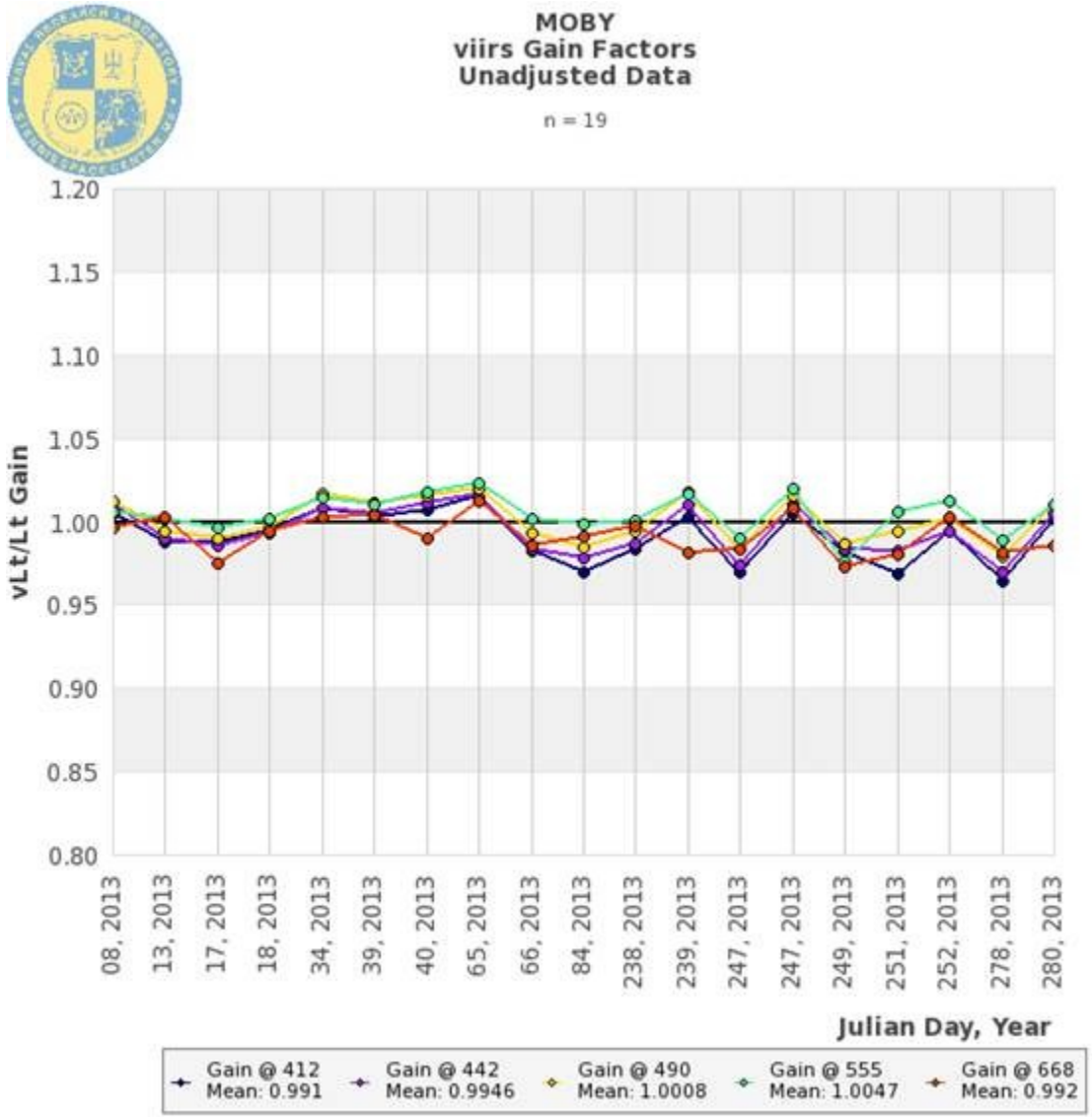
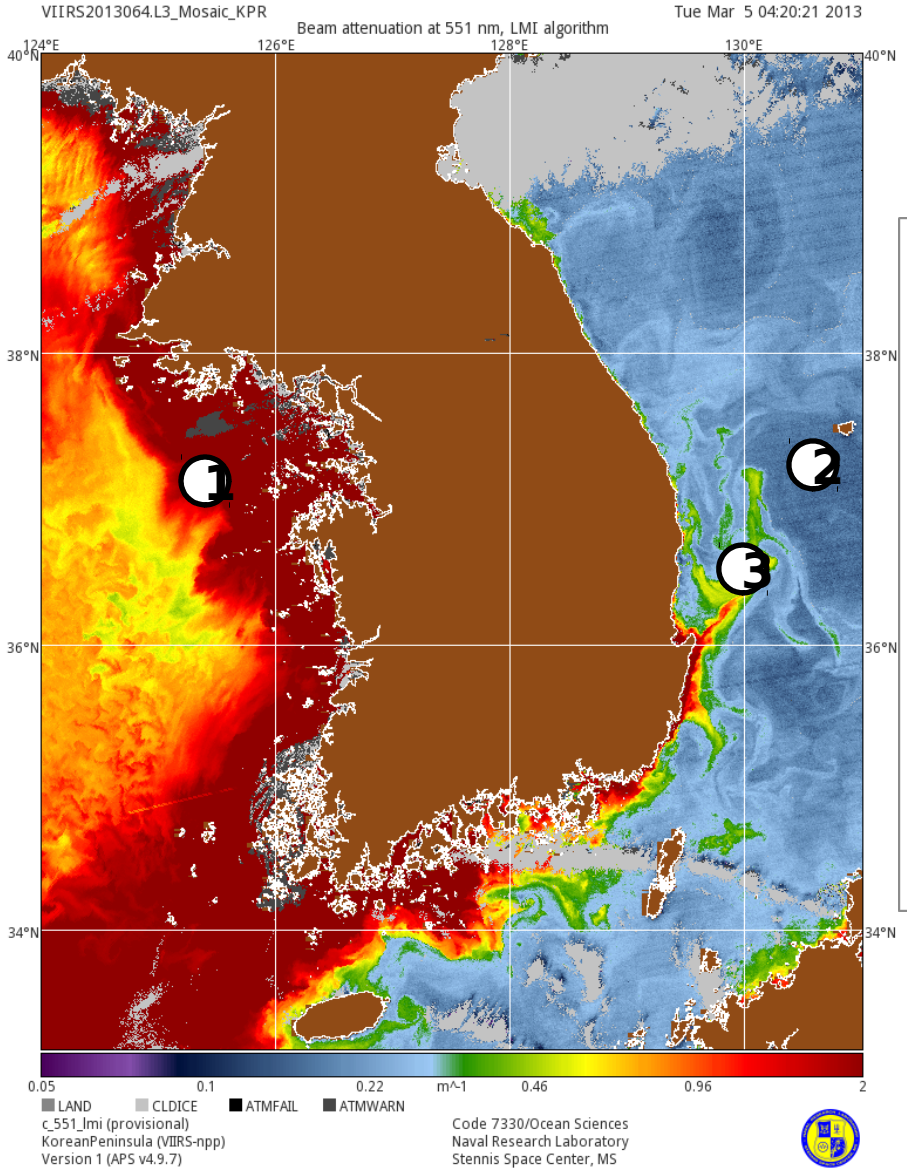
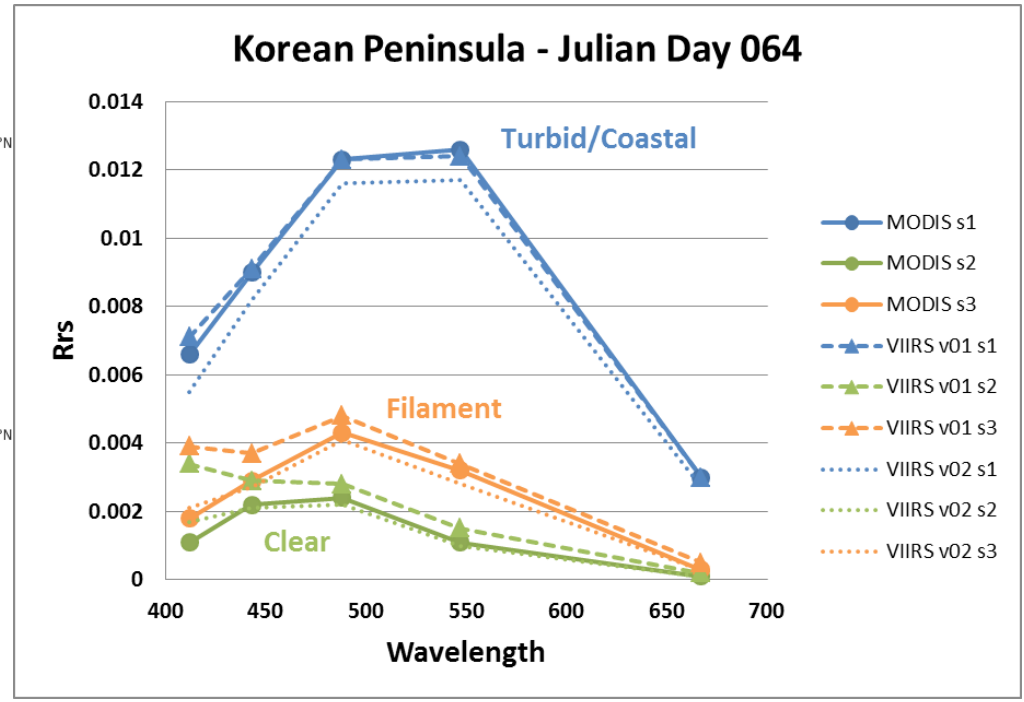


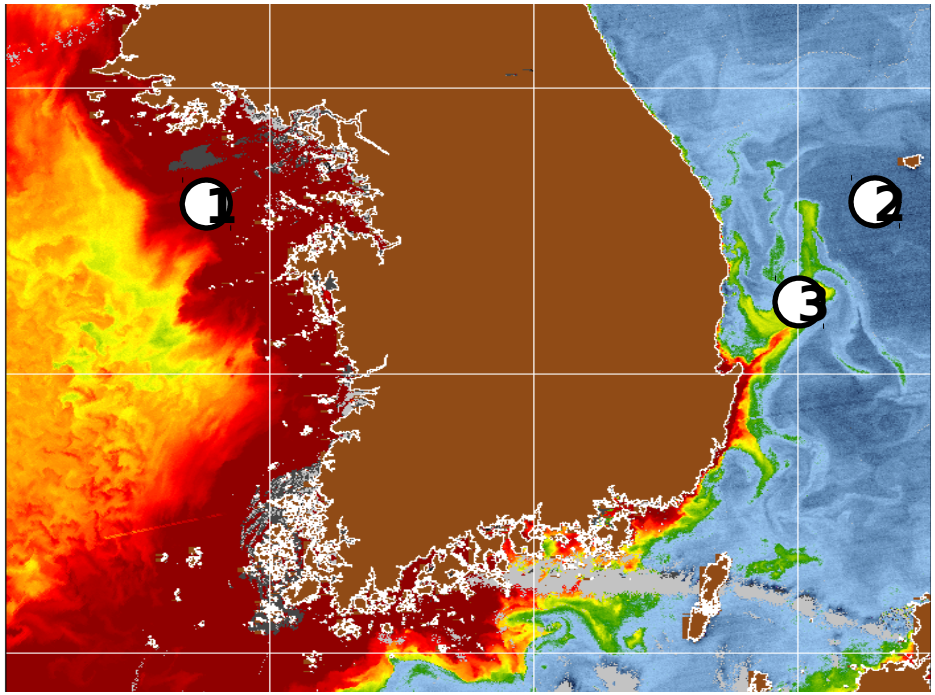

**Figure 3 shows the vLt/Lt relationship over time by processing the MOBY imagery with the vicarious calibration coefficients. The ratios vary around the 1.0 line suggesting the sensor with vicarious calibration is on average performing better than it does with unity gains. The mean gain for the 412, 442, 490, 555, and 668 channels are 0.9910, 0.9946, 1.0008, 1.0047, and 0.992 respectively.**

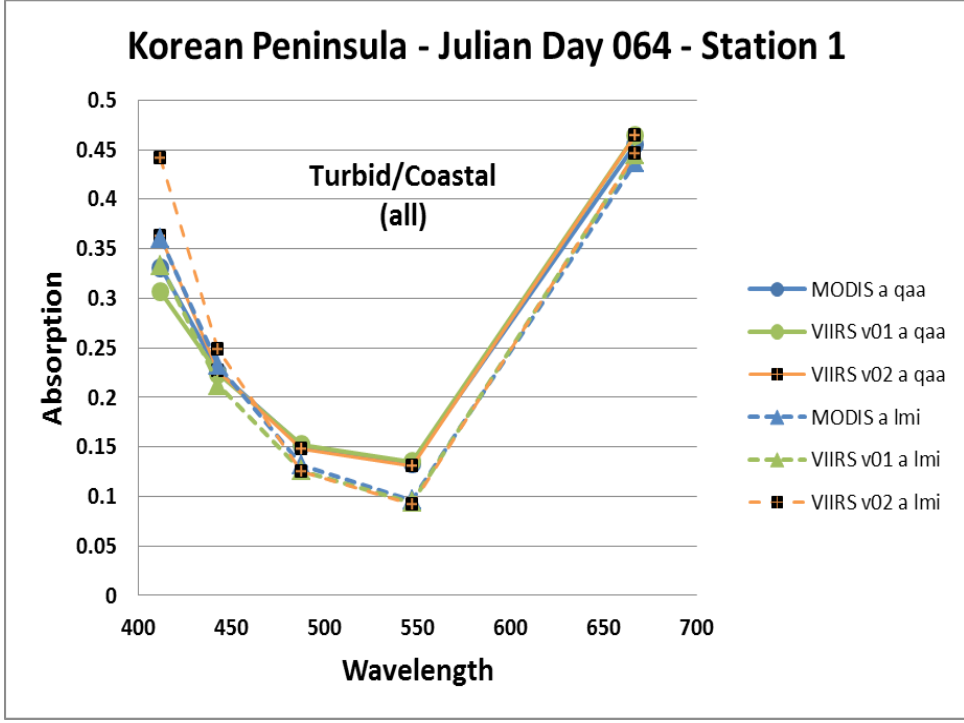
# Korean Peninsula – March 5, 2013 – QAA vs LMI – MODIS vs VIIR
# AOPS v4.10

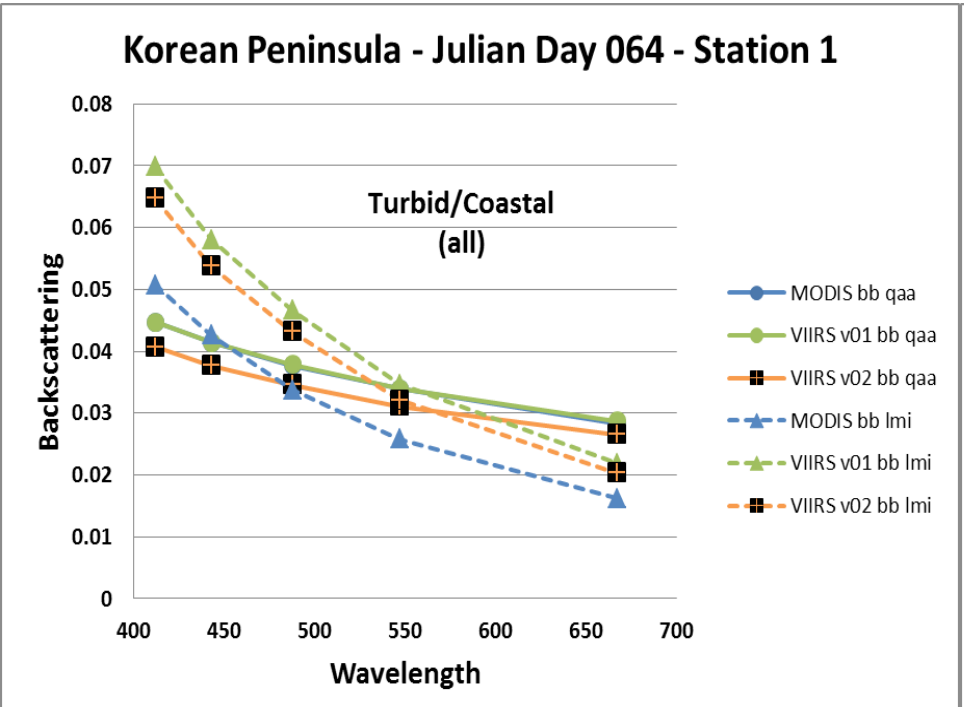


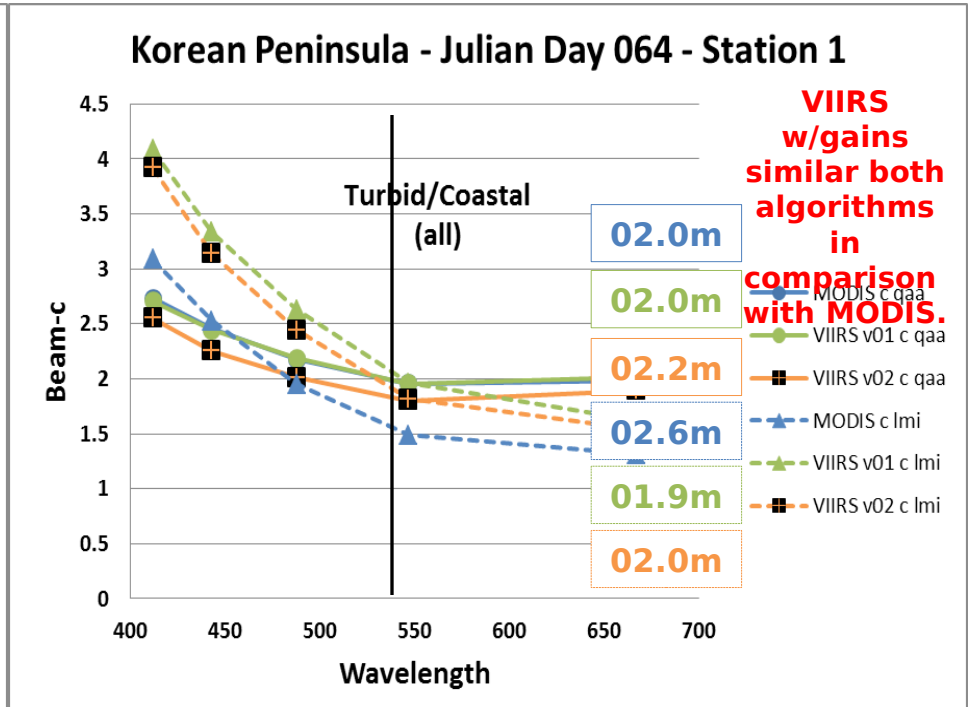

**VIIRS(gains) vs, MODIS Rrs improvement at stations 2 & 3 in comparison to MODIS**

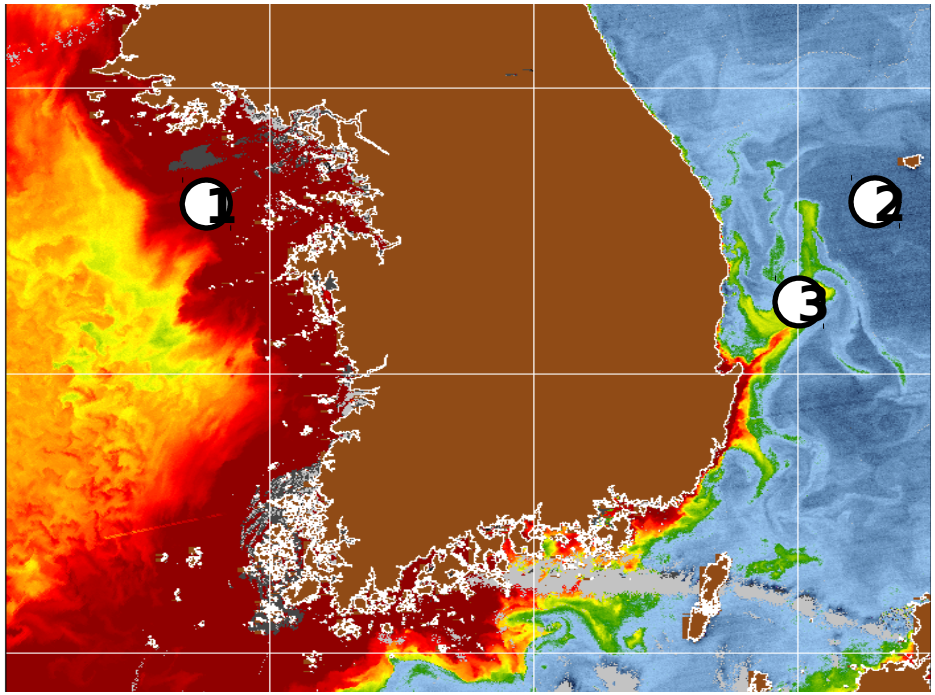


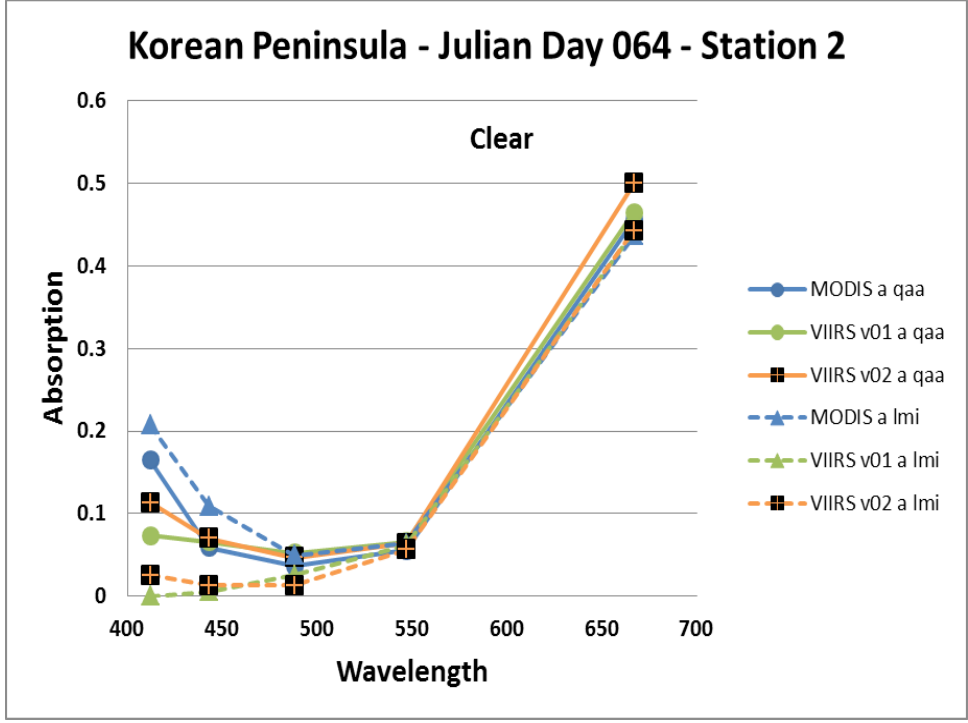

1
2
3

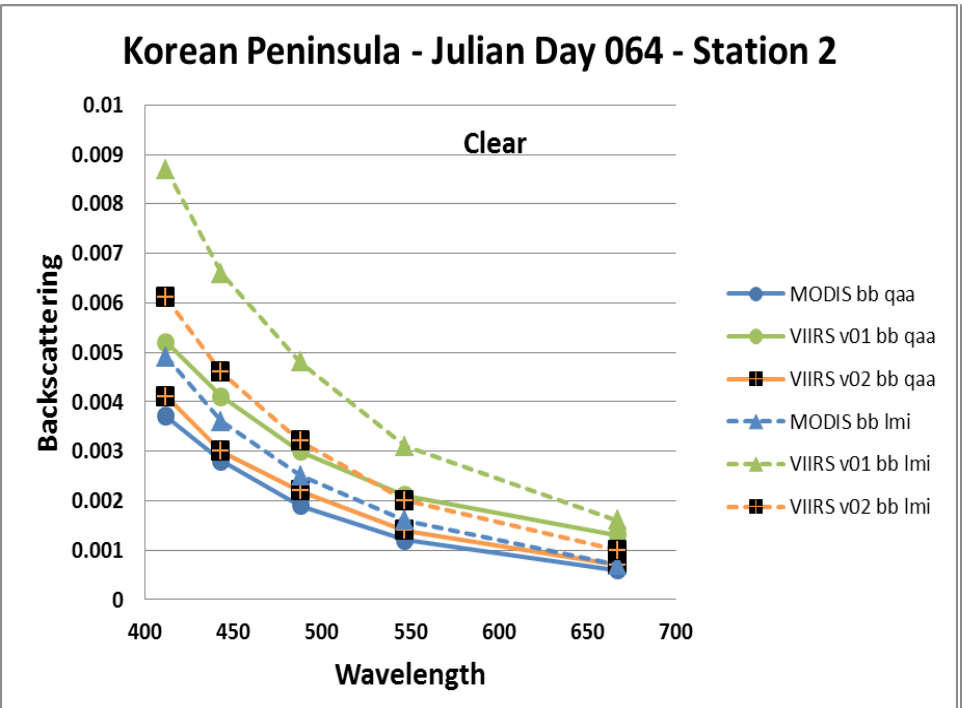

Korean Peninsula - Julian Day 064 - Station 1
Turbid/Coastal
(all)
Absorption
Wavelength
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
400
450
500
550
600
650
700
MODIS a qaa
VIIRS v01 a qaa
VIIRS v02 a qaa
MODIS a lmi
VIIRS v01 a lmi
VIIRS v02 a lmi

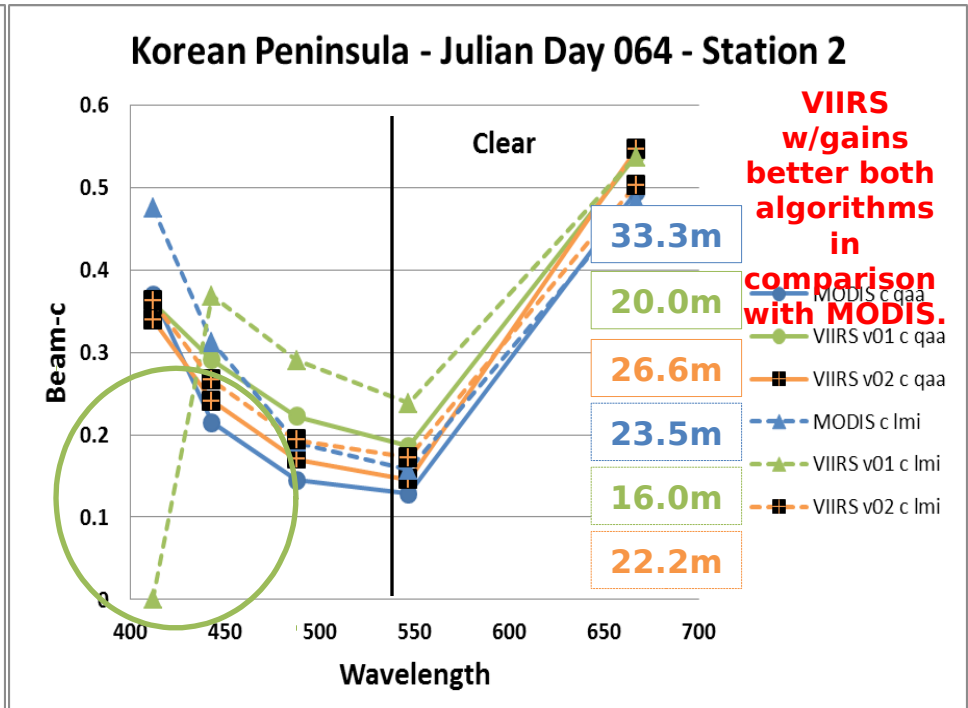

Korean Peninsula - Julian Day 064 - Station 1
Turbid/Coastal
(all)
Backscattering
Wavelength
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
400
450
500
550
600
650
700
MODIS bb qaa
VIIRS v01 bb qaa
VIIRS v02 bb qaa
MODIS bb lmi
VIIRS v01 bb lmi
VIIRS v02 bb lmi

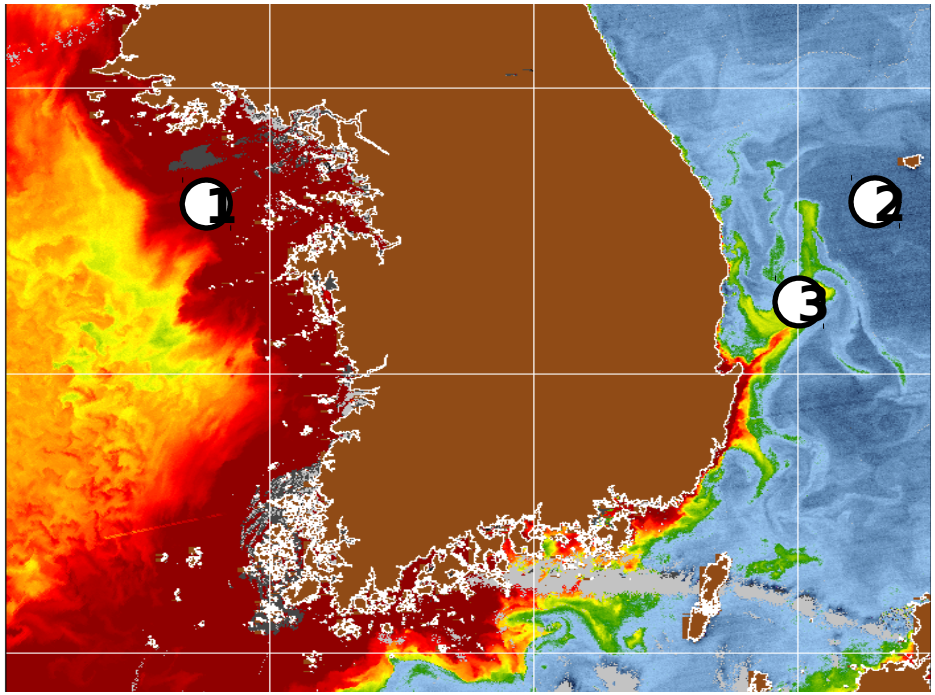

Korean Peninsula - Julian Day 064 - Station 1
Turbid/Coastal
(all)
Beam-c
Wavelength
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
400
450
500
550
600
650
700
02.0m
02.0m
02.2m
02.6m
01.9m
02.0m
VIIRS w/gains similar both algorithms in comparison with MODIS.
MODIS c qaa
VIIRS v01 c qaa
VIIRS v02 c qaa
MODIS c lmi
VIIRS v01 c lmi
VIIRS v02 c lmi

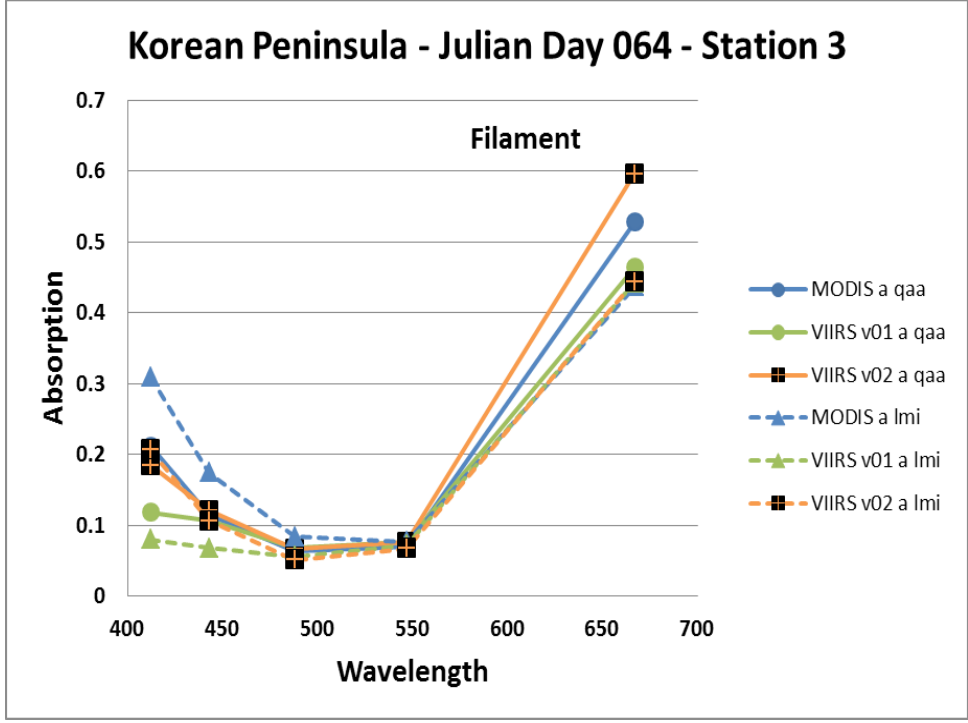

1
2
3

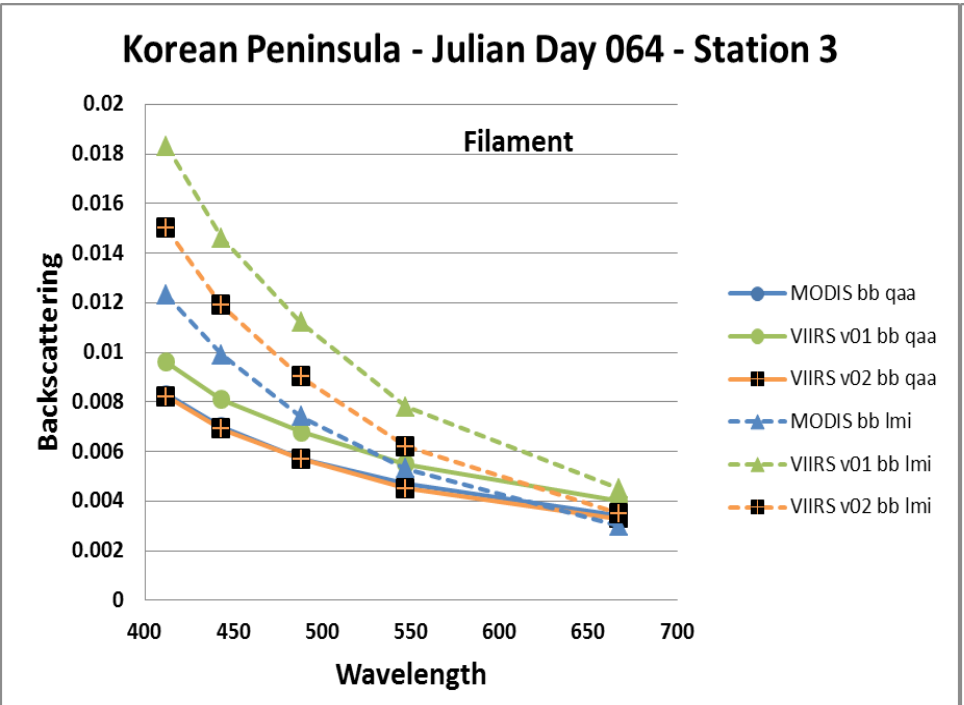

Korean Peninsula - Julian Day 064 - Station 2
Clear
Absorption
Wavelength
MODIS a qaa
VIIRS v01 a qaa
VIIRS v02 a qaa
MODIS a lmi
VIIRS v01 a lmi
VIIRS v02 a lmi

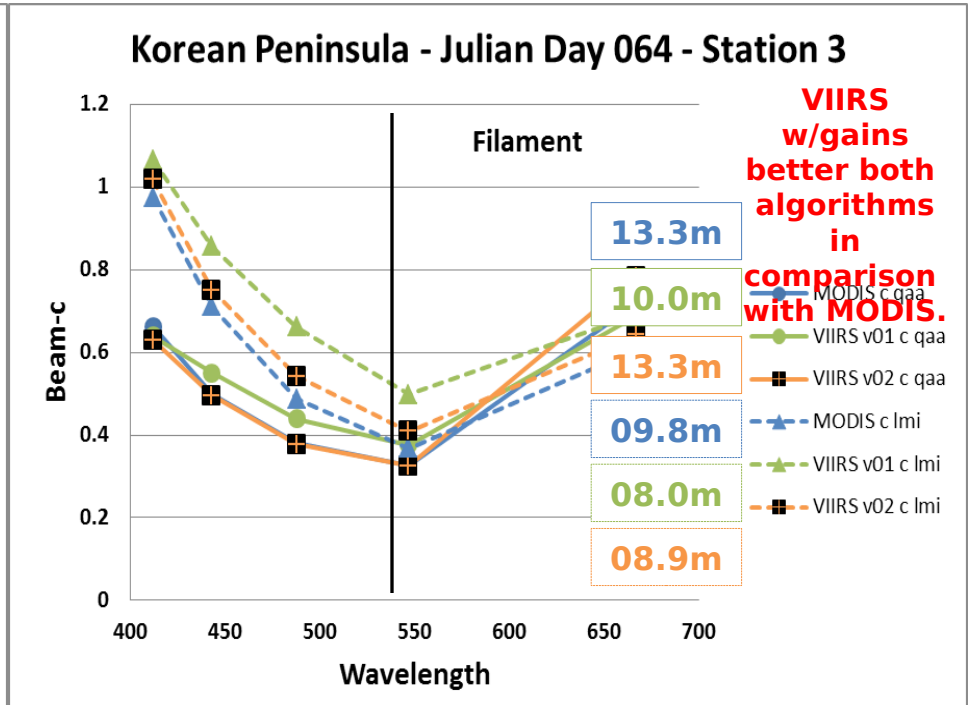

Korean Peninsula - Julian Day 064 - Station 2
Clear
Backscattering
Wavelength
MODIS bb qaa
VIIRS v01 bb qaa
VIIRS v02 bb qaa
MODIS bb lmi
VIIRS v01 bb lmi
VIIRS v02 bb lmi


Korean Peninsula - Julian Day 064 - Station 2
Clear
Beam-c
Wavelength
33.3m
20.0m
26.6m
23.5m
16.0m
22.2m
VIIRS w/gains better both algorithms in comparison with MODIS.
MODIS c qaa
VIIRS v01 c qaa
VIIRS v02 c qaa
MODIS c lmi
VIIRS v01 c lmi
VIIRS v02 c lmi

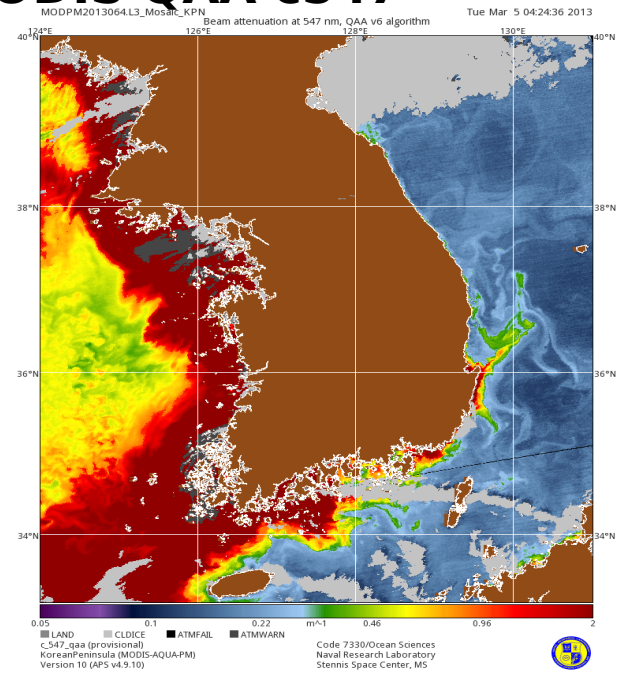

1
2
3


Korean Peninsula - Julian Day 064 - Station 3
Filament
Absorption
Wavelength
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
400
450
500
550
600
650
700
MODIS a qaa
VIIRS v01 a qaa
VIIRS v02 a qaa
MODIS a lmi
VIIRS v01 a lmi
VIIRS v02 a lmi

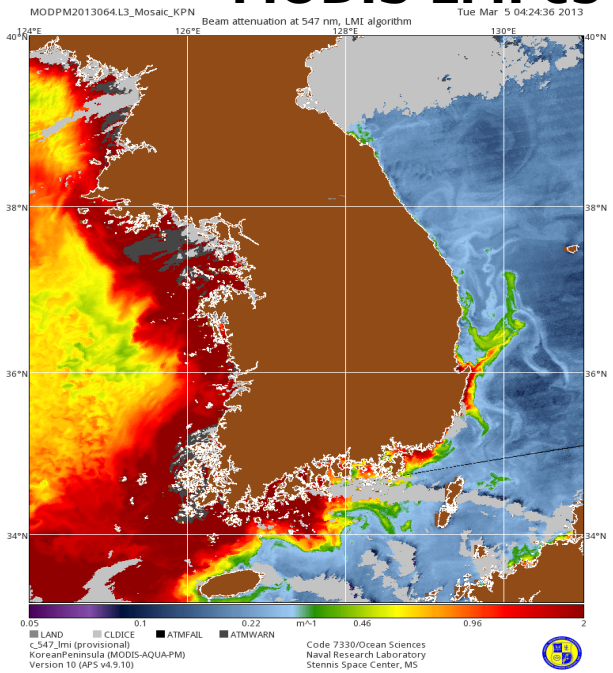

Korean Peninsula - Julian Day 064 - Station 3
Filament
Backscattering
Wavelength
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
400
450
500
550
600
650
700
MODIS bb qaa
VIIRS v01 bb qaa
VIIRS v02 bb qaa
MODIS bb lmi
VIIRS v01 bb lmi
VIIRS v02 bb lmi

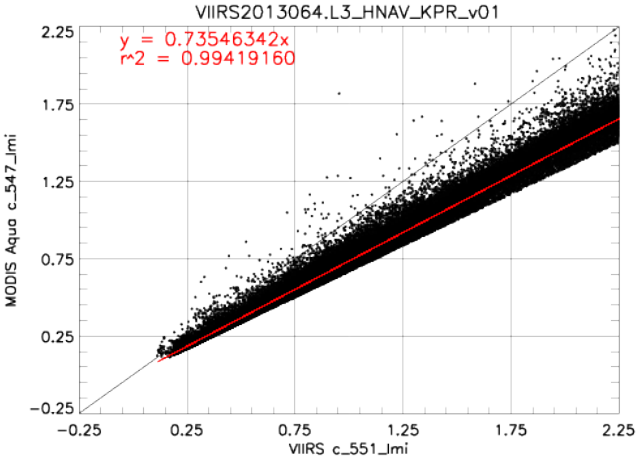

Korean Peninsula - Julian Day 064 - Station 3
Filament
Beam-c
Wavelength
1.2
1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700
13.3m
10.0m
13.3m
09.8m
08.0m
08.9m
VIIRS w/gains better both algorithms in comparison with MODIS.
MODIS c qaa
VIIRS v01 c qaa
VIIRS v02 c qaa
MODIS c lmi
VIIRS v01 c lmi
VIIRS v02 c lmi

# ODIS QAA c547

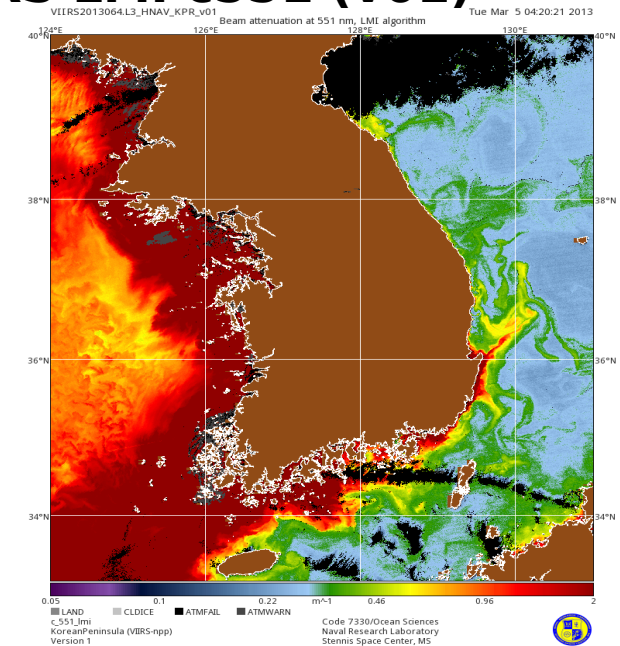



# MODIS LMI c547

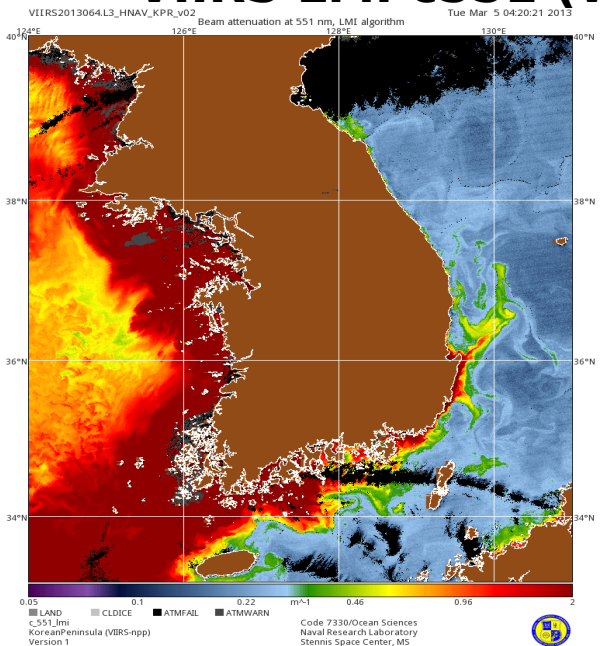


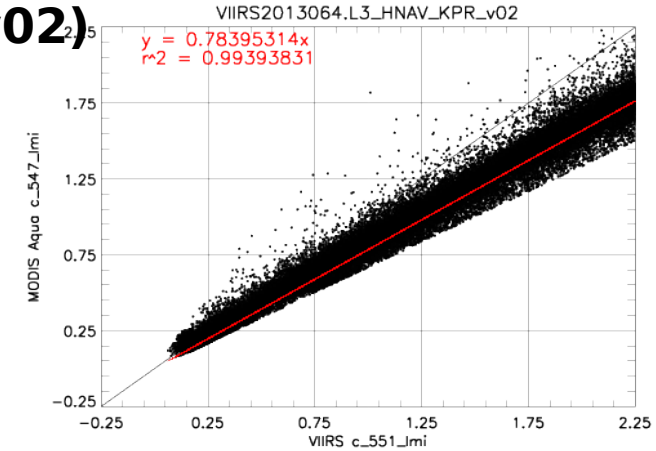




# RS LMI c551 (v01)




# VIIRS LMI c551 (v02)

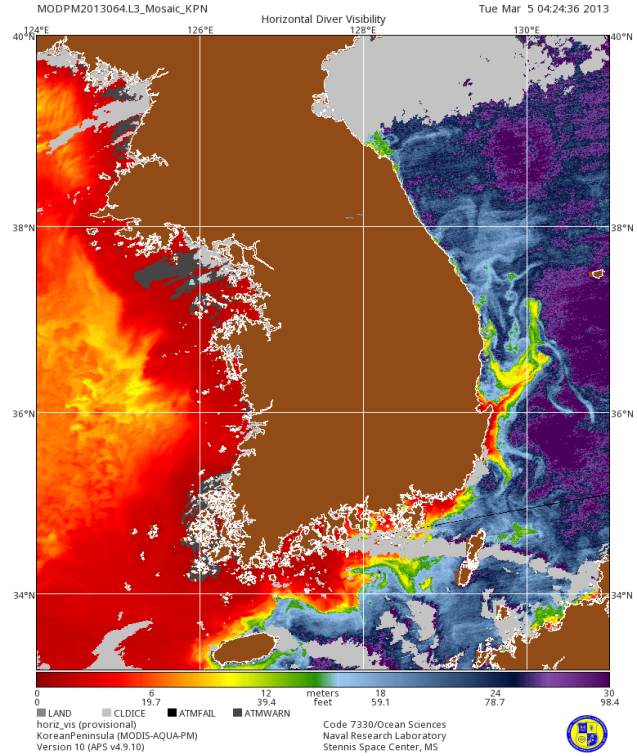


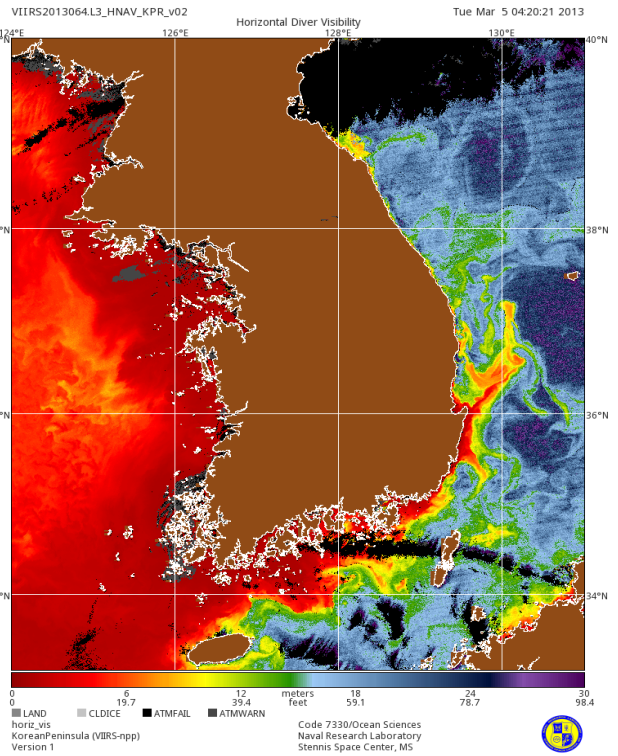



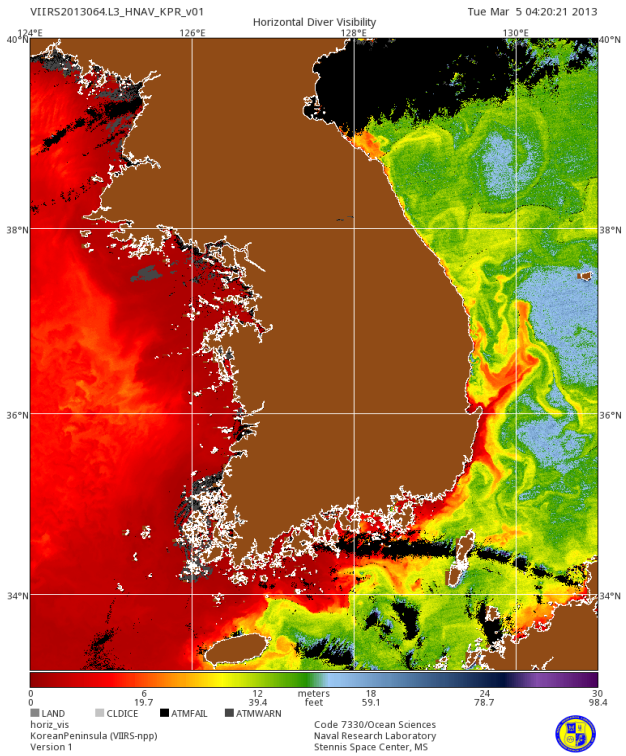
# ODIS

# VIIRS (v02)

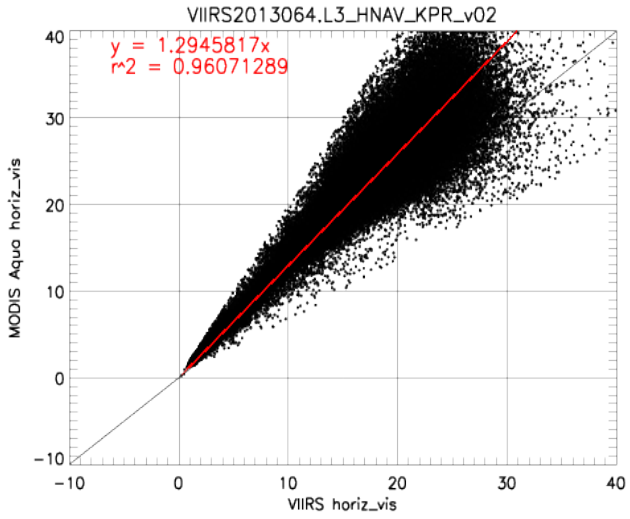
# VIIRS

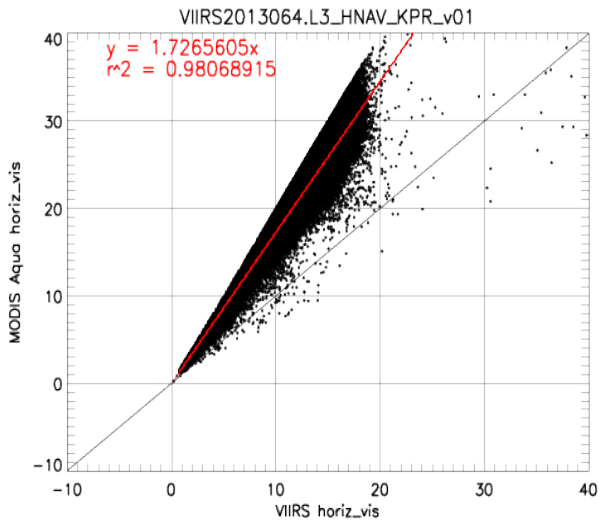



**HORIZONTAL VISIBILITY (LMI 531)**

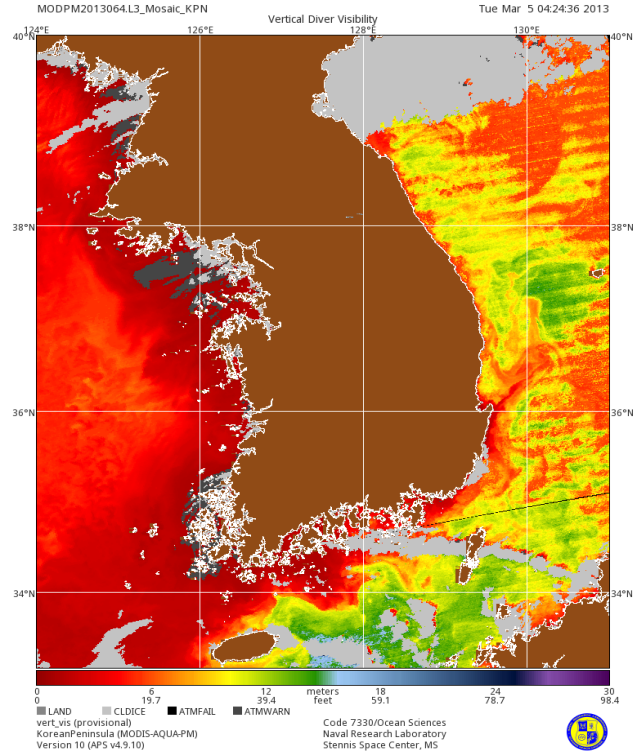


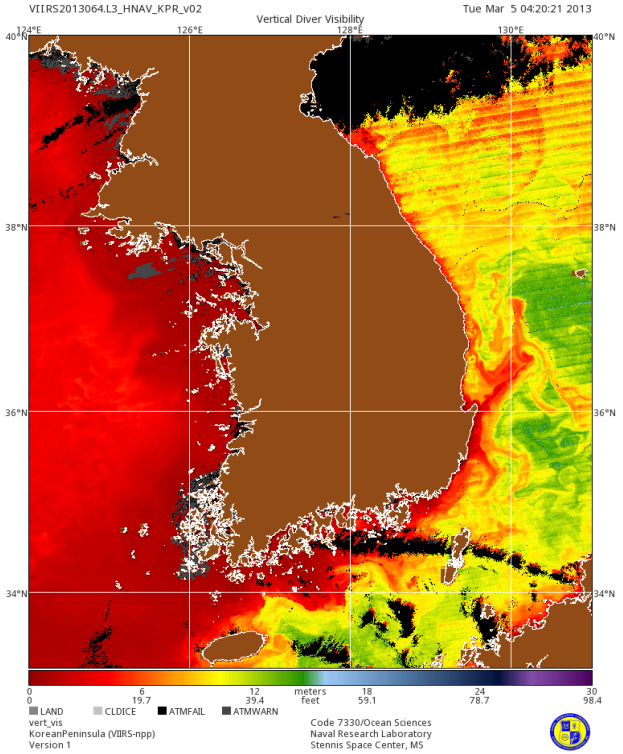



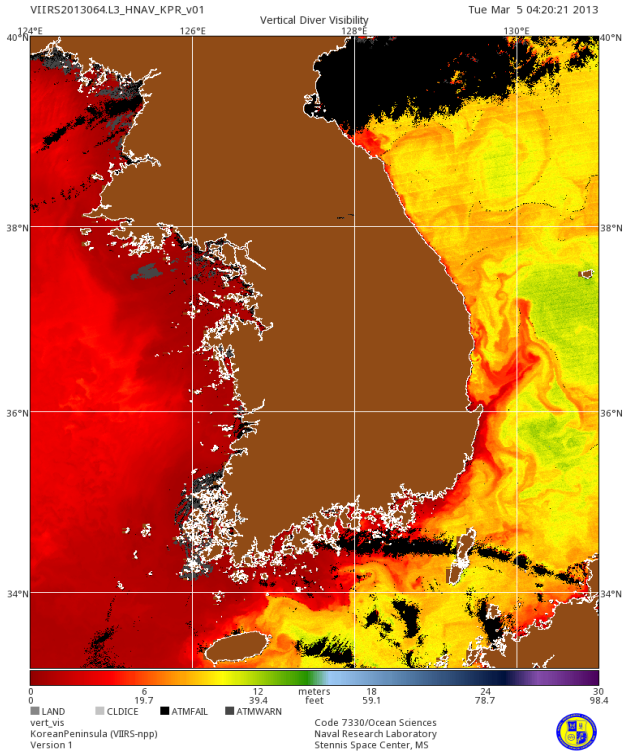
# DIS

# VIIRS (v02)

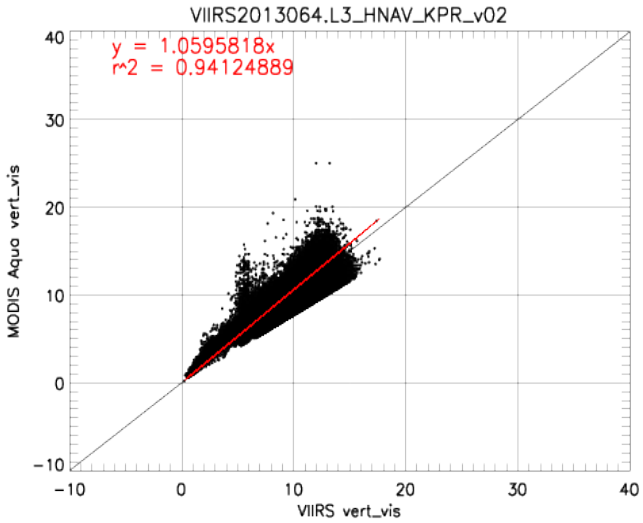
# VIIRS

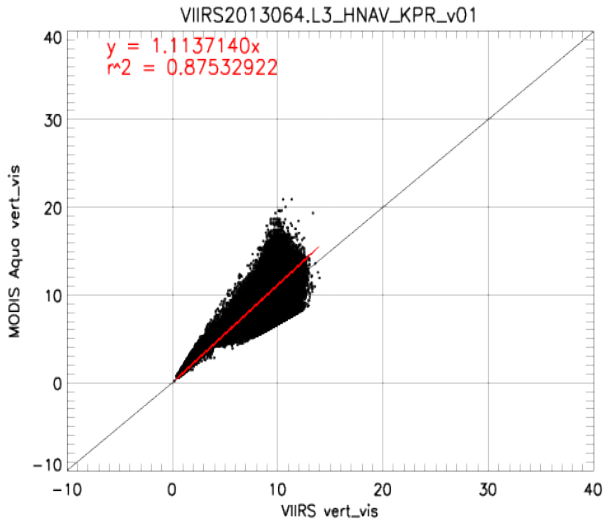


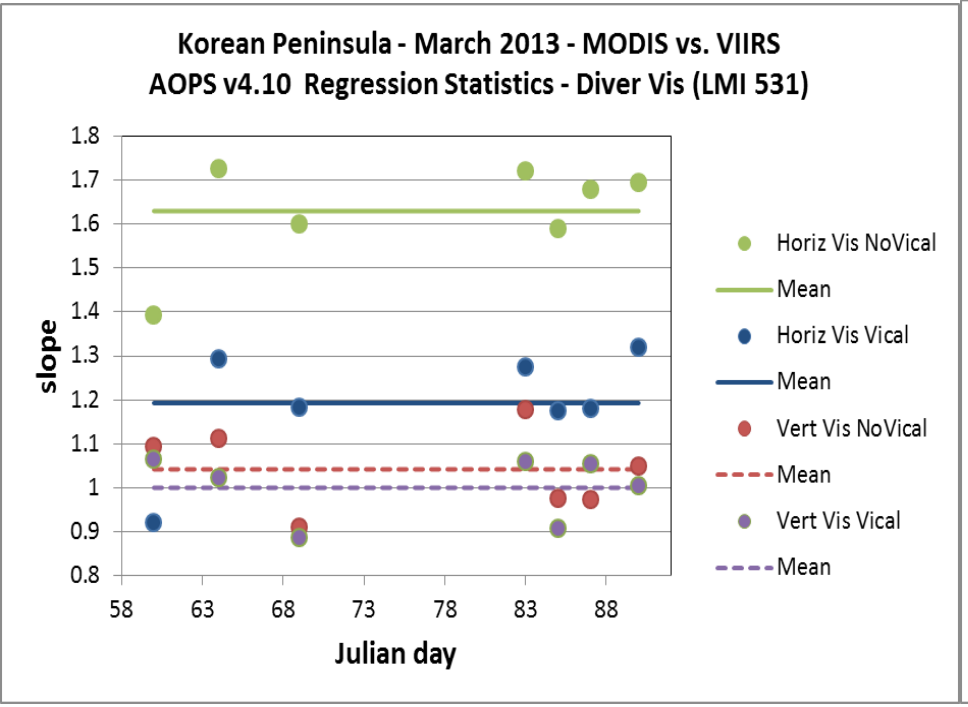



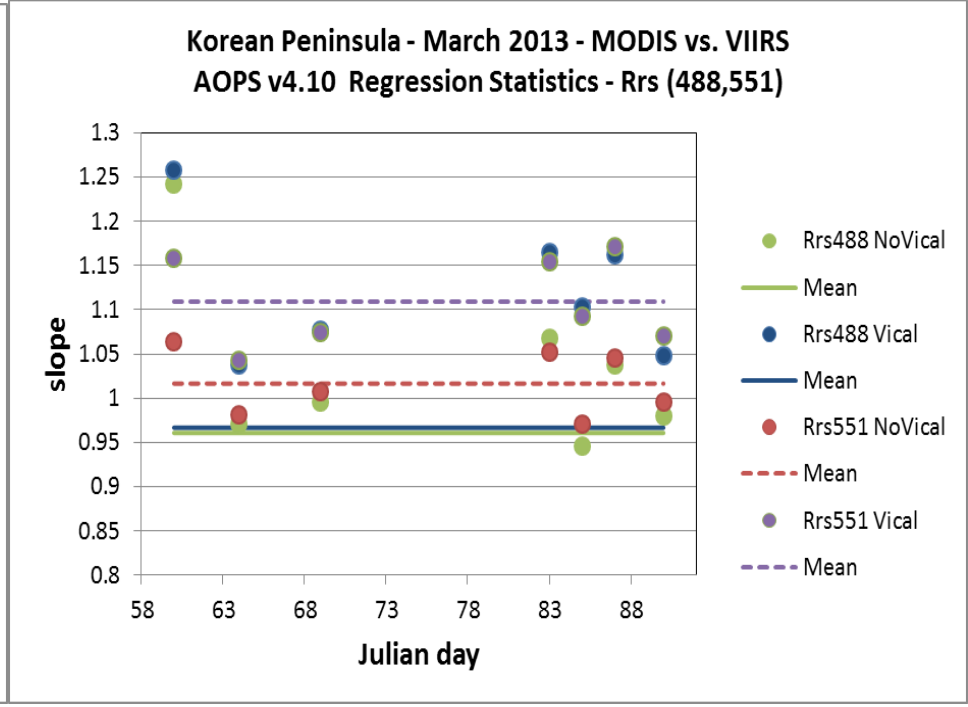



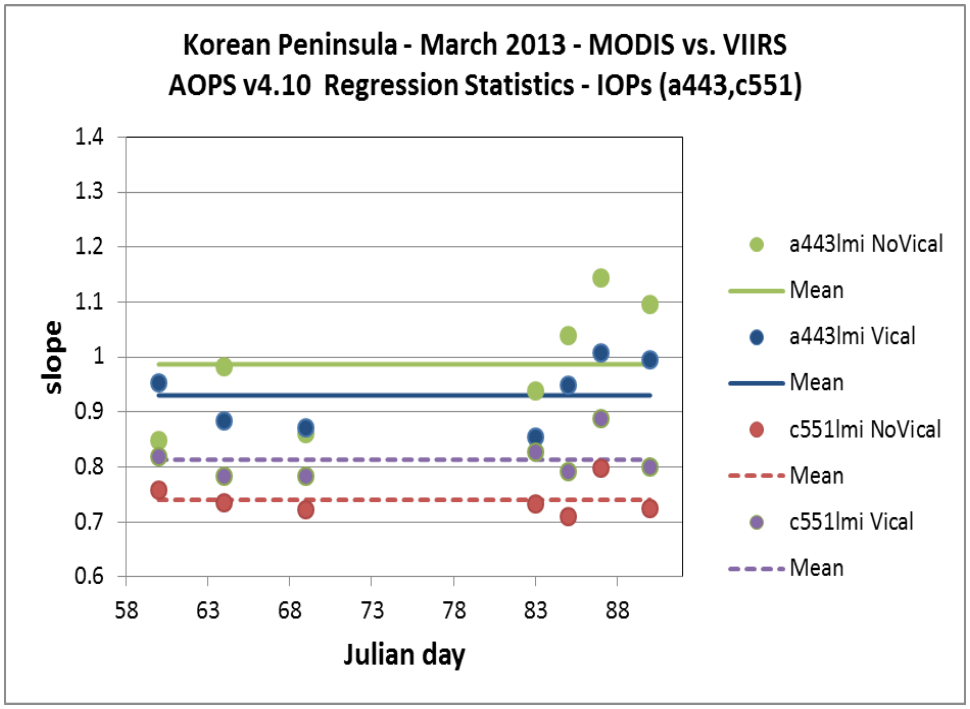

**VERTICAL VISIBILITY (LMI 531)**



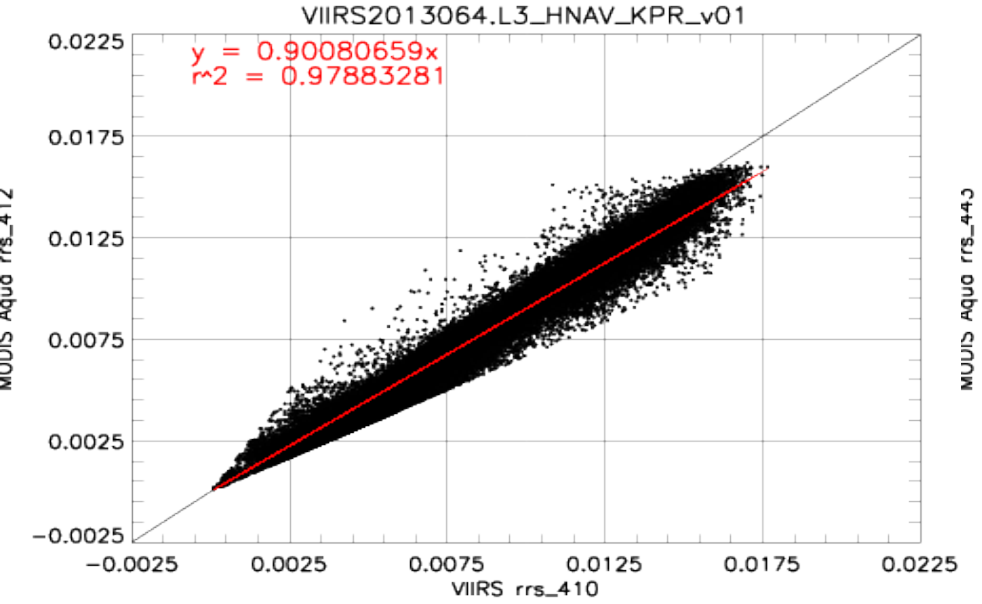



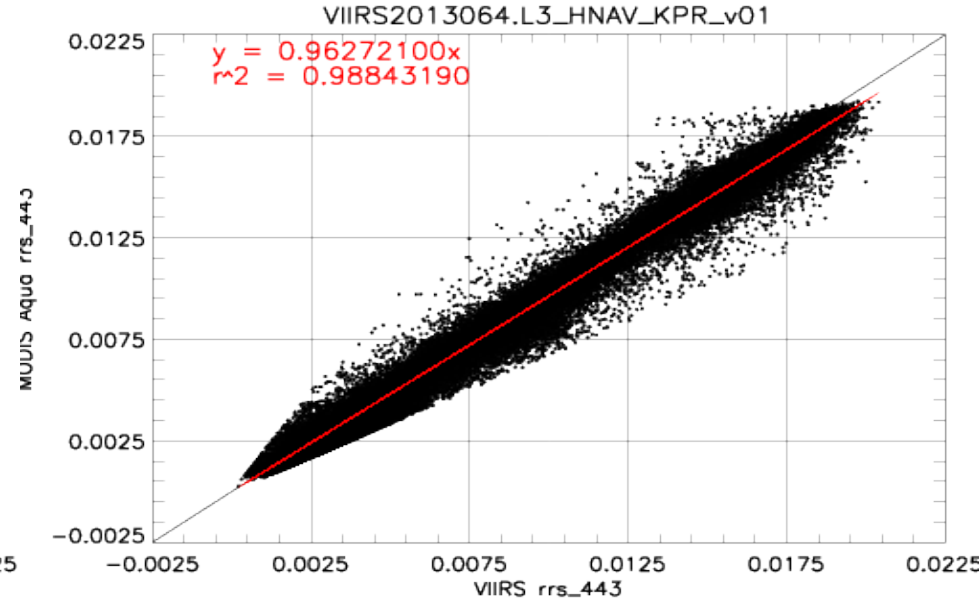

Korean Peninsula - March 2013 - MODIS vs. VIIRS
AOPS v4.10 Regression Statistics - Diver Vis (LMI 531)
slope
Julian day
Horiz Vis NoVical
Mean
Horiz Vis Vical
Mean
Vert Vis NoVical
Mean
Vert Vis Vical
Mean

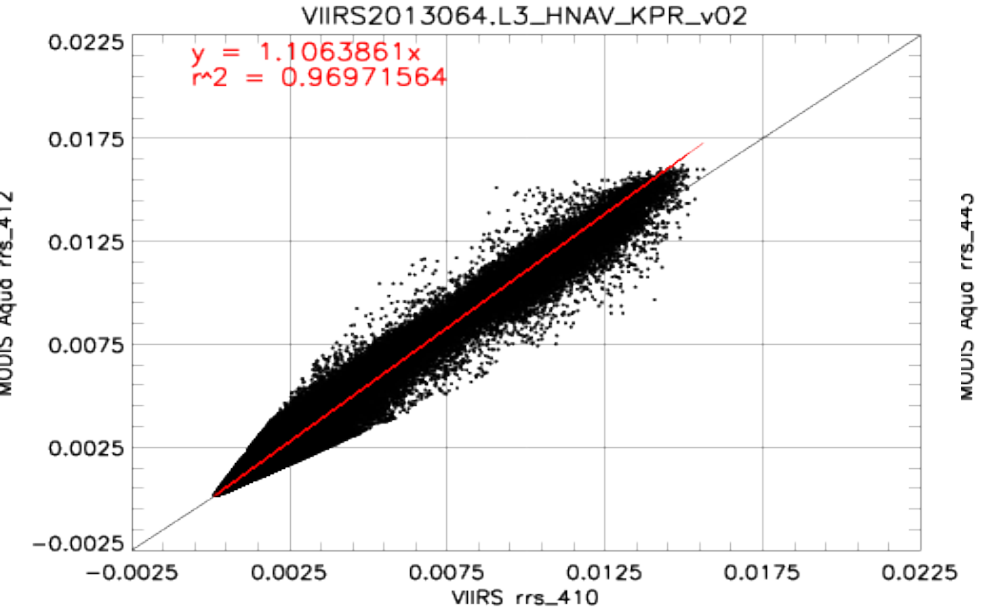

Korean Peninsula - March 2013 - MODIS vs. VIIRS
AOPS v4.10 Regression Statistics - Rrs (488,551)
slope
Julian day
Rrs488 NoVical
Mean
Rrs488 Vical
Mean
Rrs551 NoVical
Mean
Rrs551 Vical
Mean

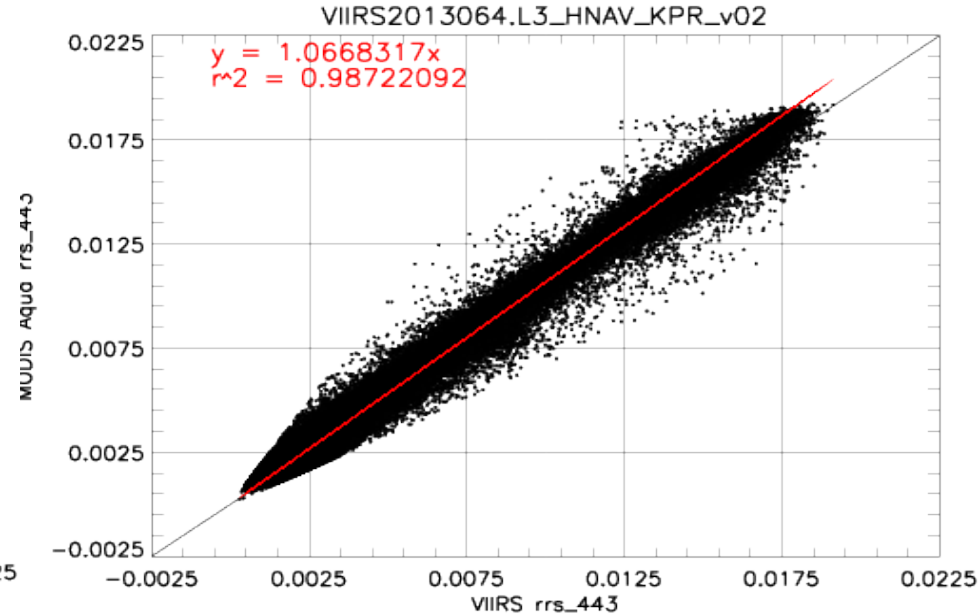

Korean Peninsula - March 2013 - MODIS vs. VIIRS
AOPS v4.10 Regression Statistics - IOPs (a443,c551)
slope
Julian day
a443lmi NoVical
Mean
a443lmi Vical
Mean
c551lmi NoVical
Mean
c551lmi Vical
Mean

# Rrs Matchup MODIS vs. VIIRS (412,443)

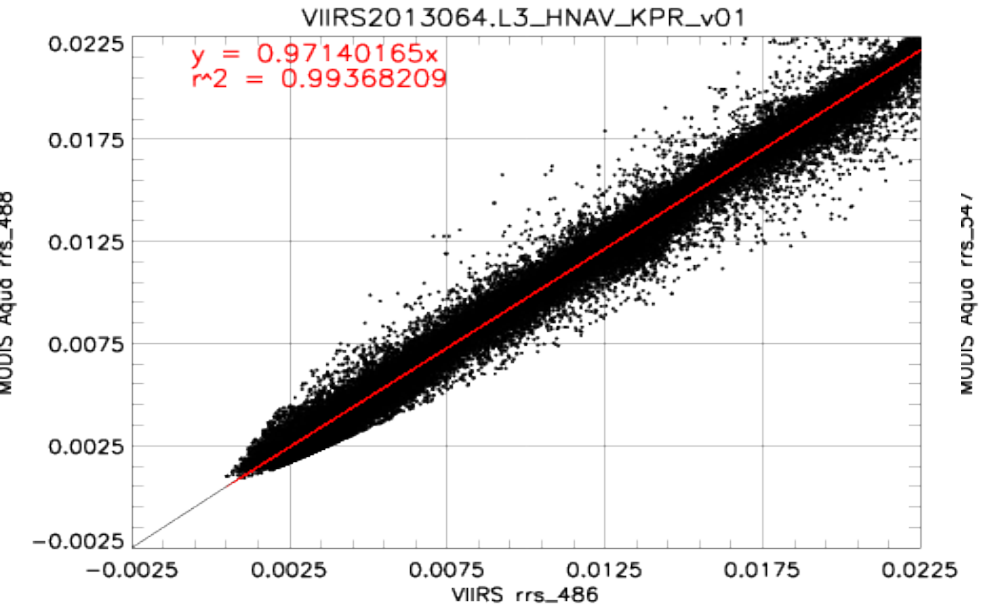


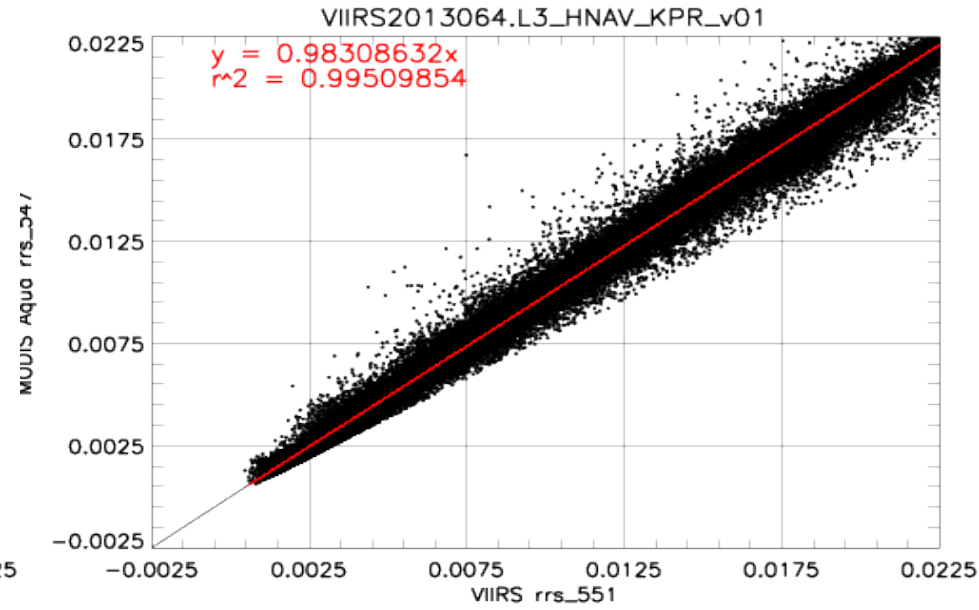



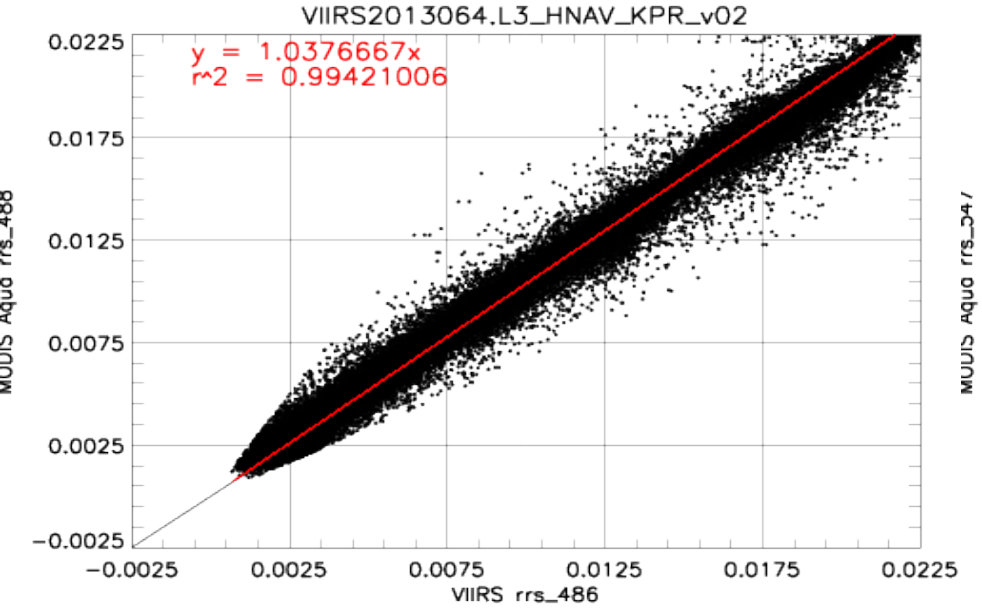



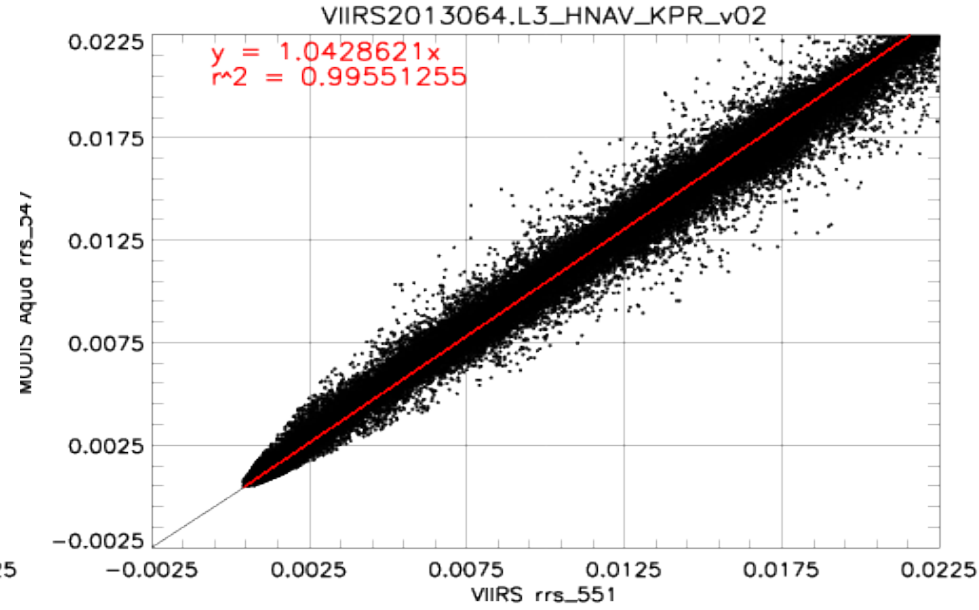



# Rrs Matchup MODIS vs. VIIRS (488,451)

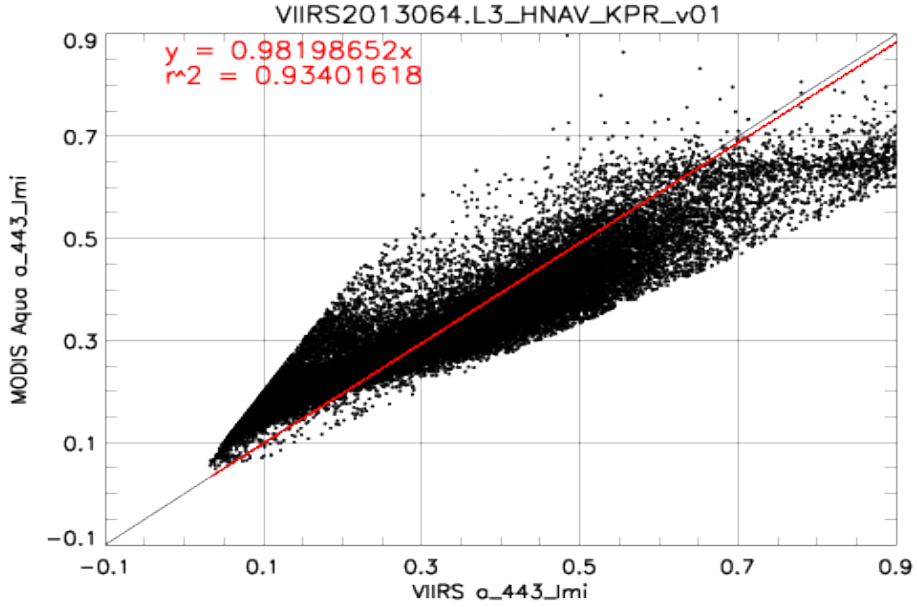


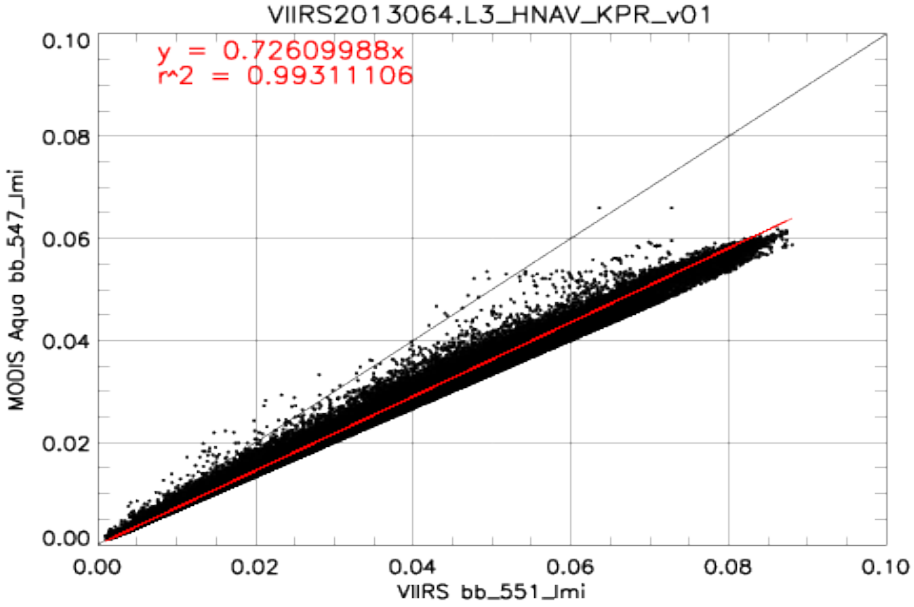



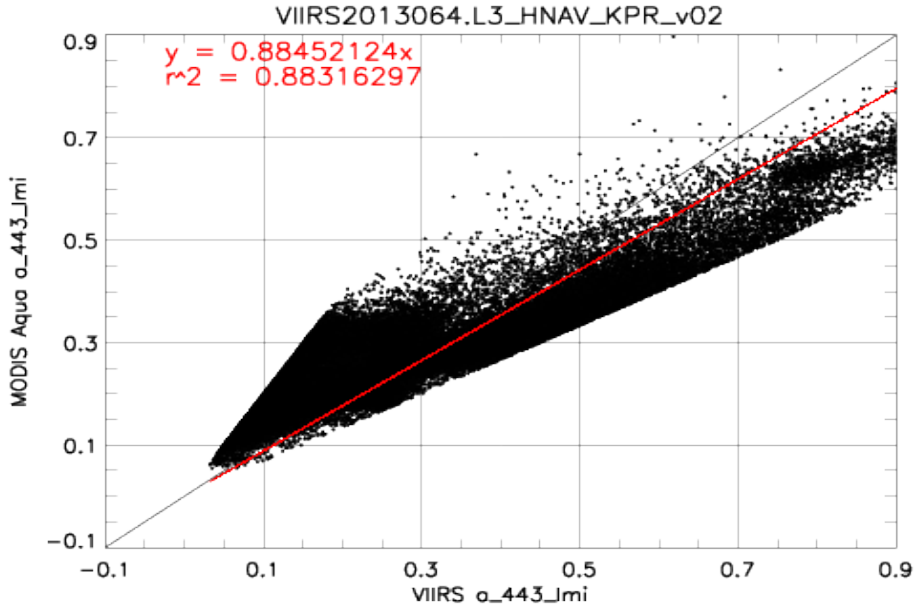



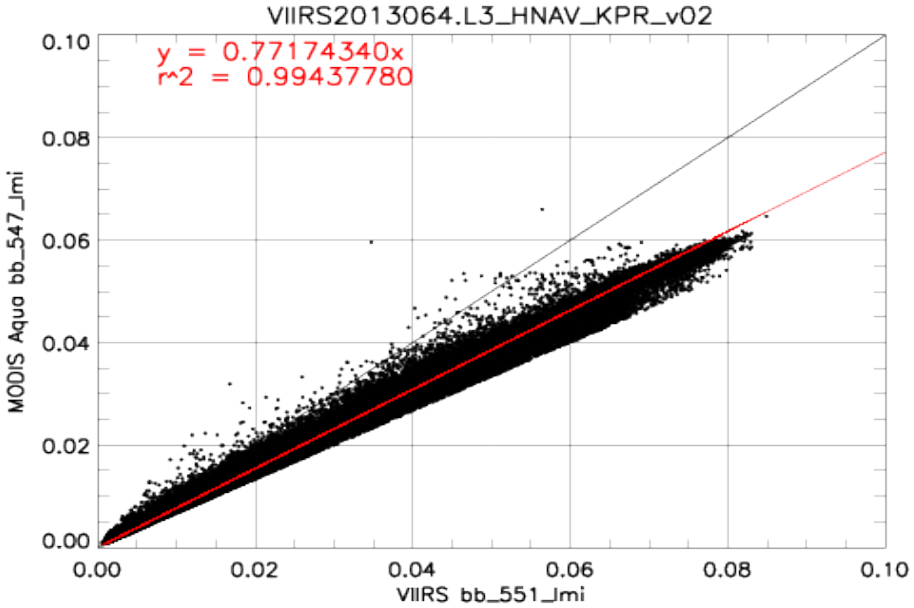



# a,bb Matchup MODIS vs. VIIRS

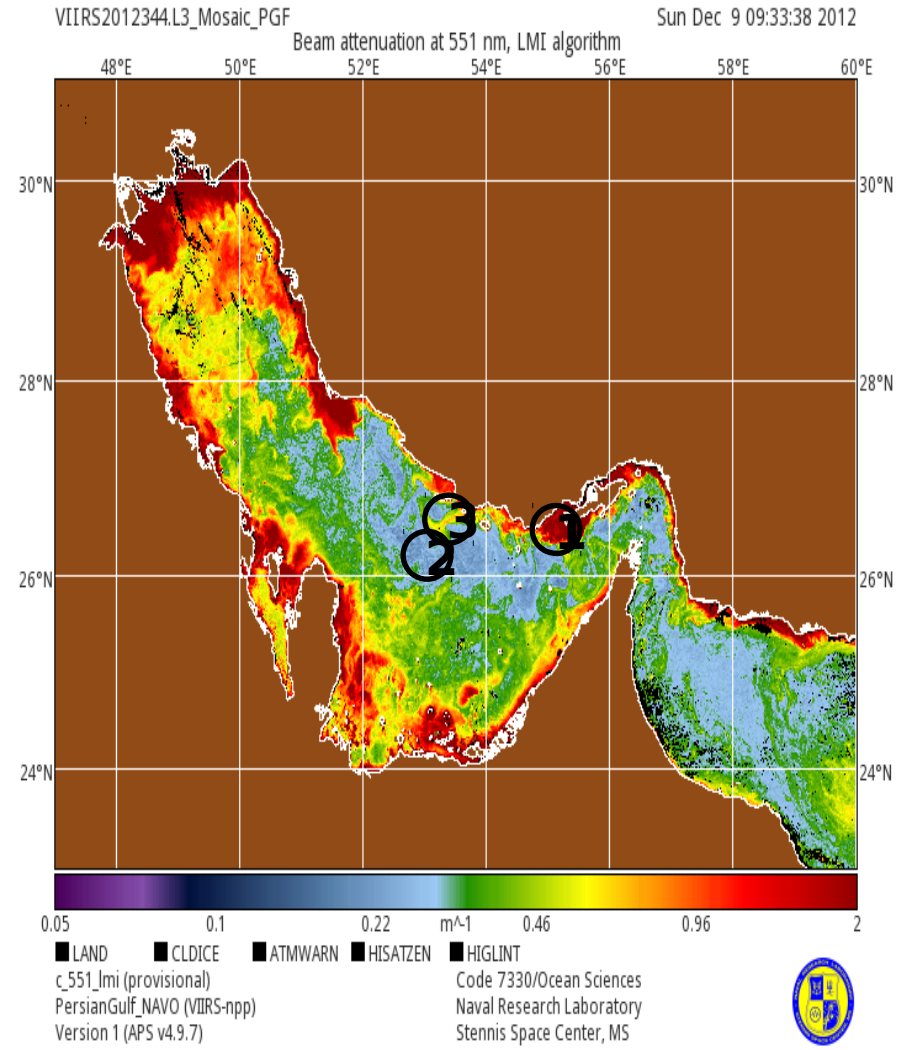


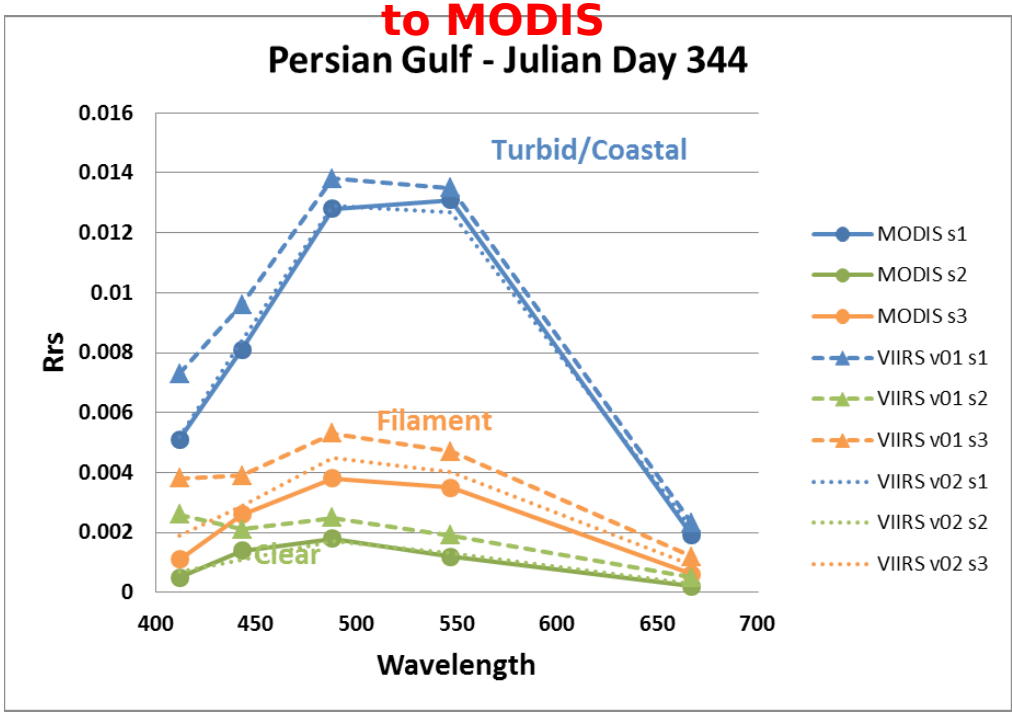



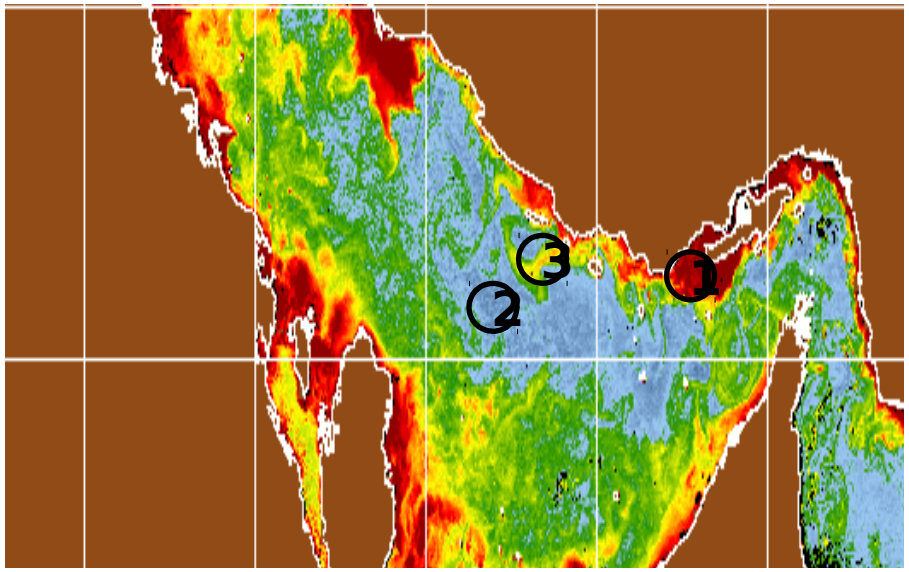



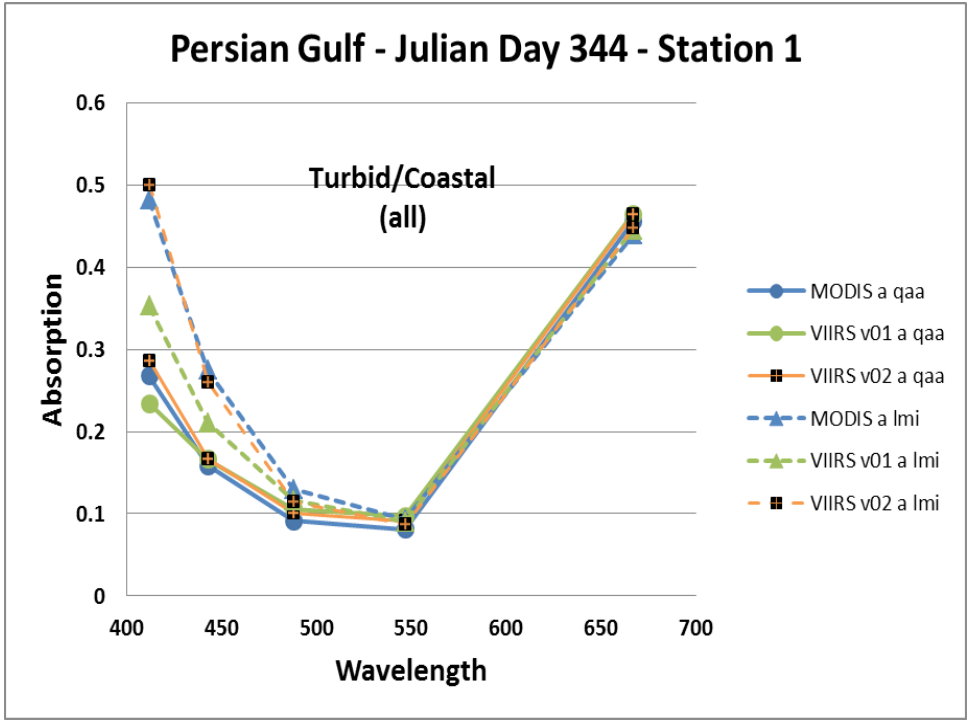
# Persian Gulf – December 09, 2012 – QAA vs LMI – MODIS vs VIIRS

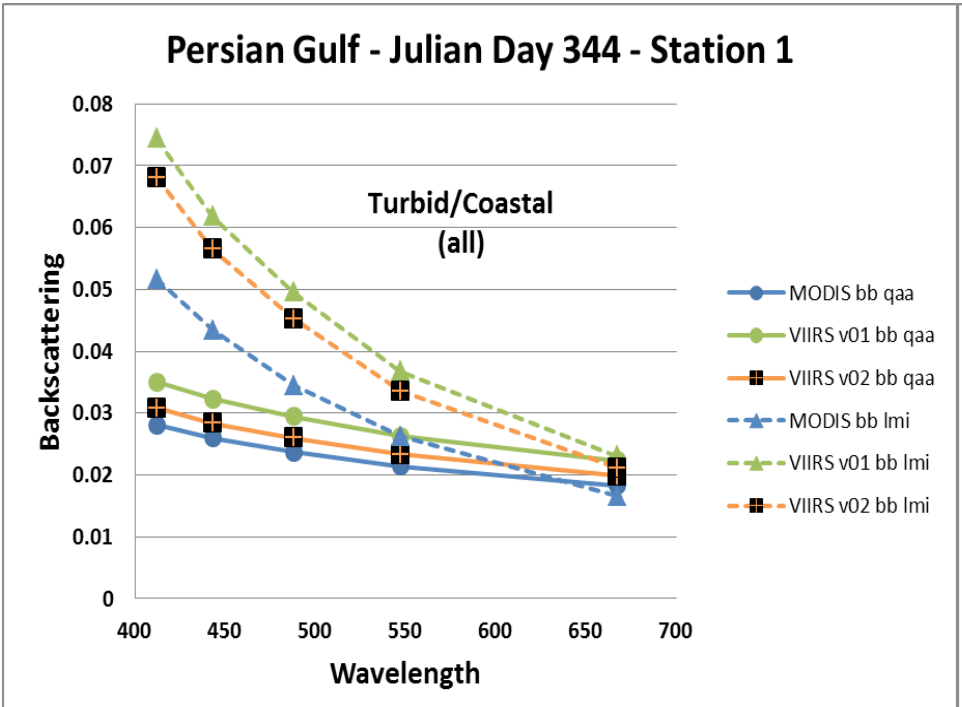


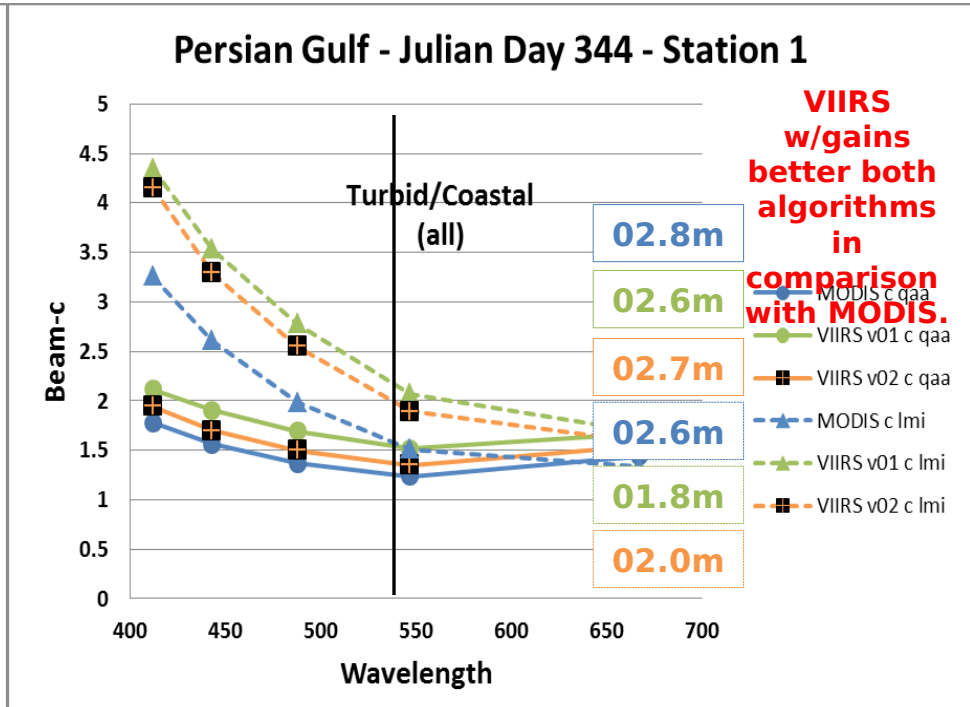

**VIIRS(gains) vs, MODIS Rrs improvement in comparison to MODIS**

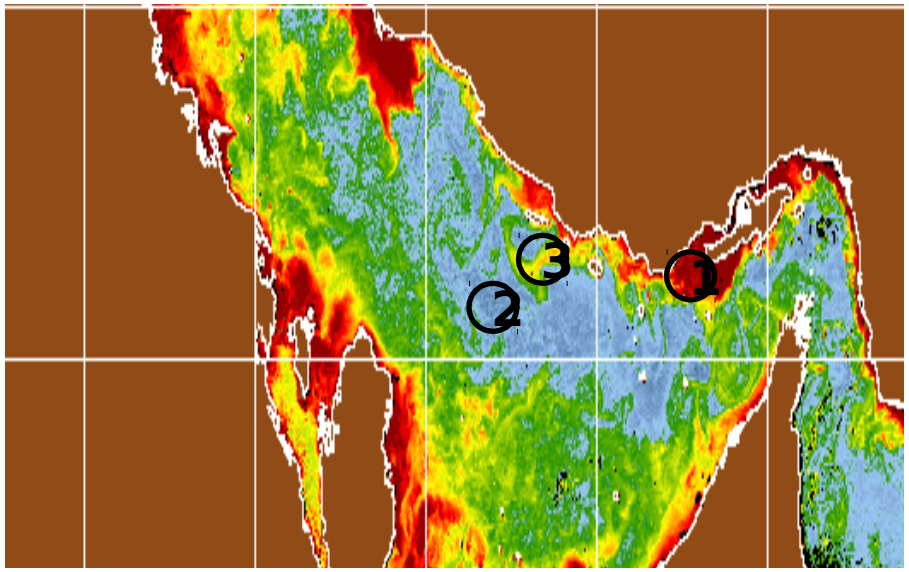


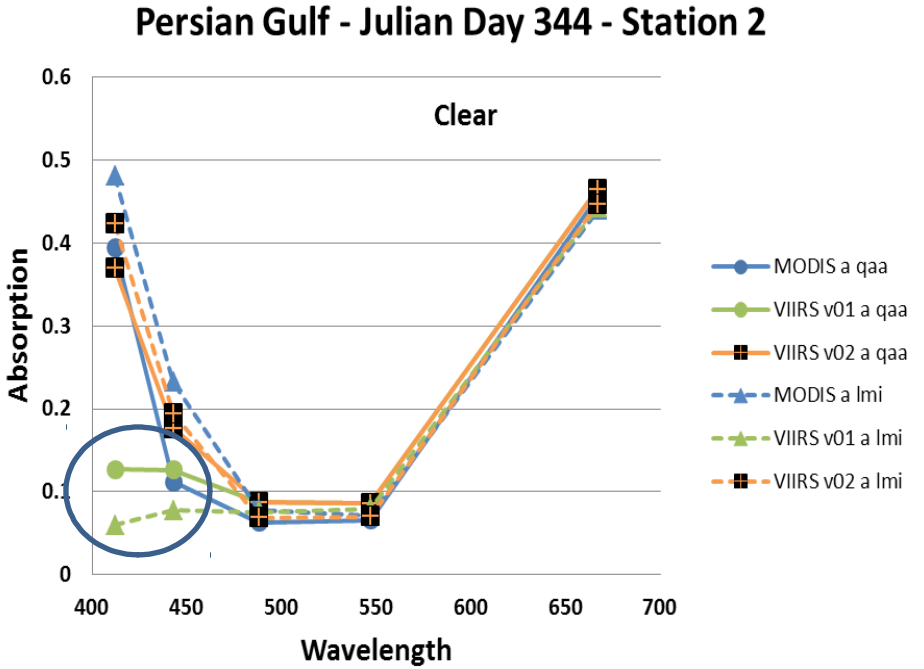

1
2
3

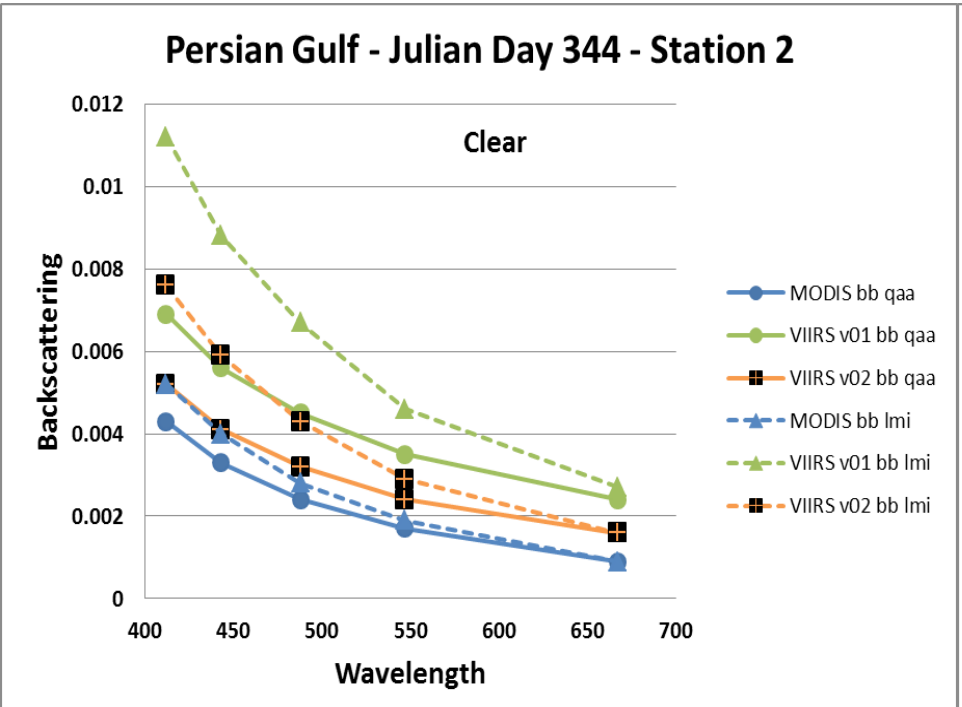

Persian Gulf - Julian Day 344 - Station 1
Turbid/Coastal
(all)
Absorption
Wavelength
0.6
0.5
0.4
0.3
0.2
0.1
0
400
450
500
550
600
650
700
MODIS a qaa
VIIRS v01 a qaa
VIIRS v02 a qaa
MODIS a lmi
VIIRS v01 a lmi
VIIRS v02 a lmi

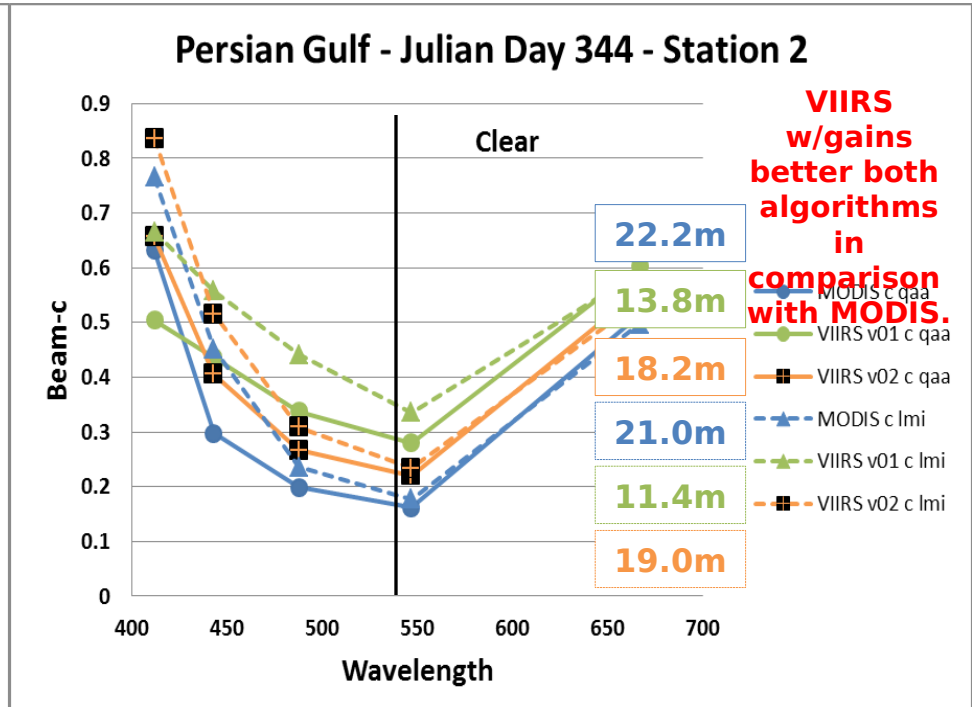

Persian Gulf - Julian Day 344 - Station 1
Turbid/Coastal
(all)
Backscattering
Wavelength
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
400
450
500
550
600
650
700
MODIS bb qaa
VIIRS v01 bb qaa
VIIRS v02 bb qaa
MODIS bb lmi
VIIRS v01 bb lmi
VIIRS v02 bb lmi

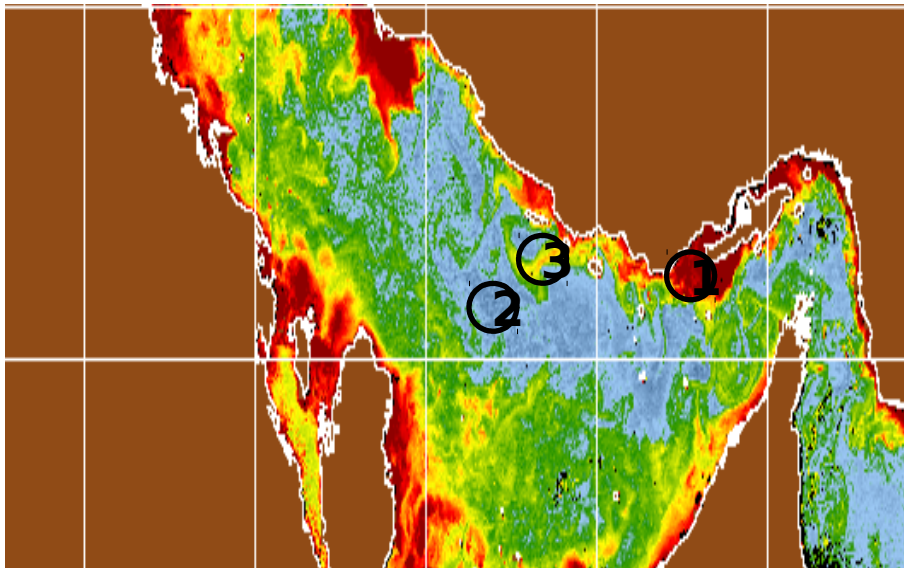

Persian Gulf - Julian Day 344 - Station 1
Turbid/Coastal
(all)
Beam-c
Wavelength
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
400
450
500
550
600
650
700
02.8m
02.6m
02.7m
02.6m
01.8m
02.0m
VIIRS w/gains better both algorithms in comparison with MODIS.
MODIS c qaa
VIIRS v01 c qaa
VIIRS v02 c qaa
MODIS c lmi
VIIRS v01 c lmi
VIIRS v02 c lmi

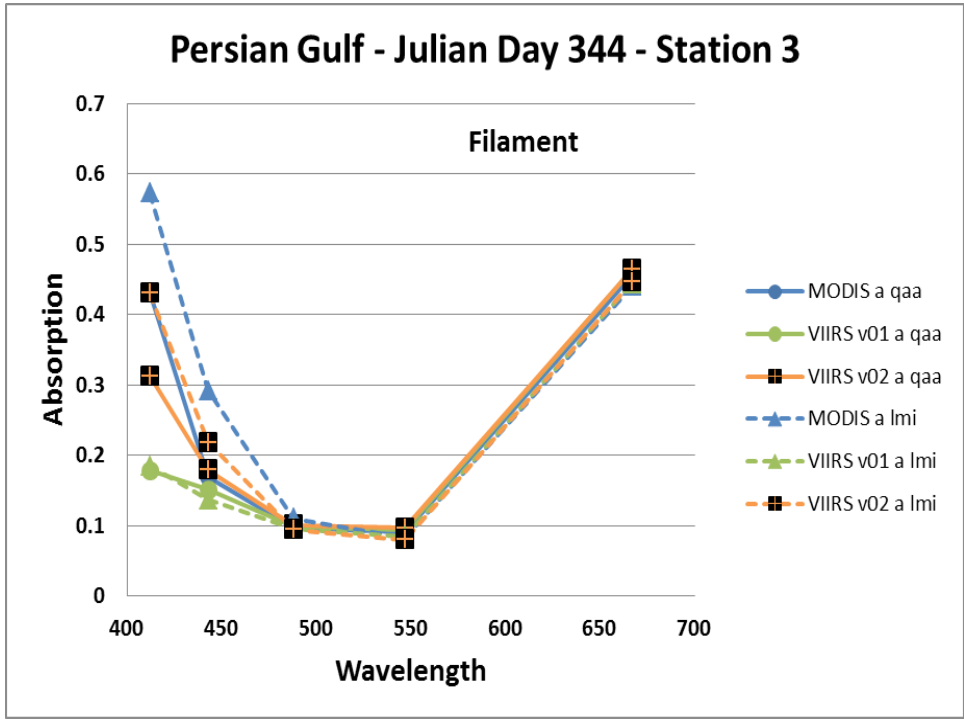

1
2
3

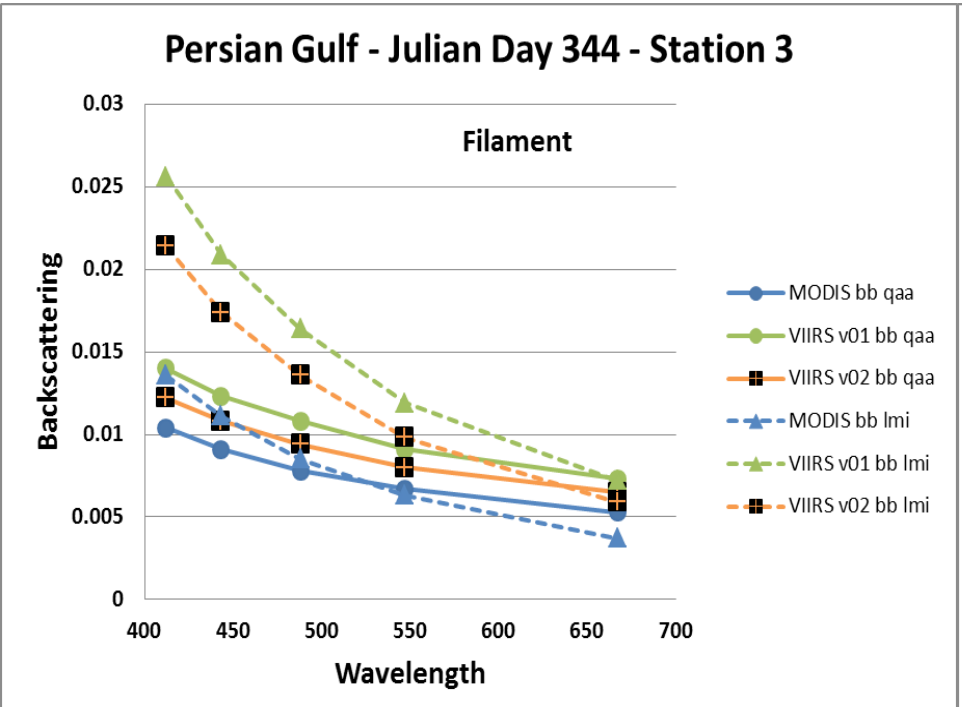

Persian Gulf - Julian Day 344 - Station 2
Clear
Absorption
Wavelength
0.6
0.5
0.4
0.3
0.2
0.1
0
400
450
500
550
600
650
700
MODIS a qaa
VIIRS v01 a qaa
VIIRS v02 a qaa
MODIS a lmi
VIIRS v01 a lmi
VIIRS v02 a lmi

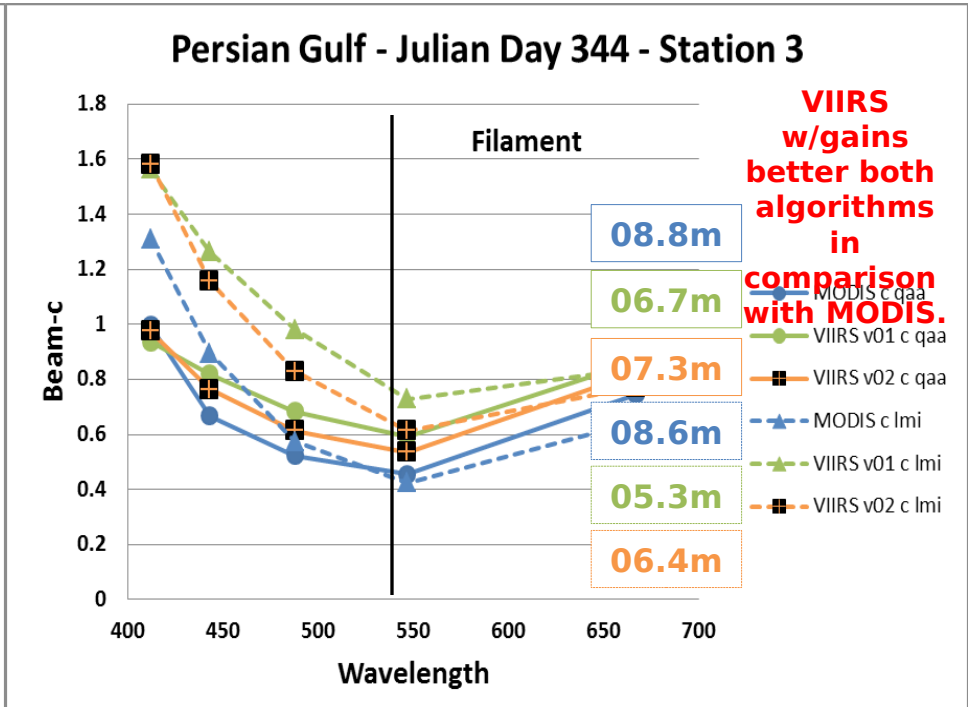

Persian Gulf - Julian Day 344 - Station 2
Clear
Backscattering
Wavelength
0.012
0.01
0.008
0.006
0.004
0.002
0
400
450
500
550
600
650
700
MODIS bb qaa
VIIRS v01 bb qaa
VIIRS v02 bb qaa
MODIS bb lmi
VIIRS v01 bb lmi
VIIRS v02 bb lmi


Persian Gulf - Julian Day 344 - Station 2
Clear
Beam-c
Wavelength
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
400
450
500
550
600
650
700
22.2m
13.8m
18.2m
21.0m
11.4m
19.0m
VIIRS w/gains better both algorithms in comparison with MODIS.
MODIS c qaa
VIIRS v01 c qaa
VIIRS v02 c qaa
MODIS c lmi
VIIRS v01 c lmi
VIIRS v02 c lmi

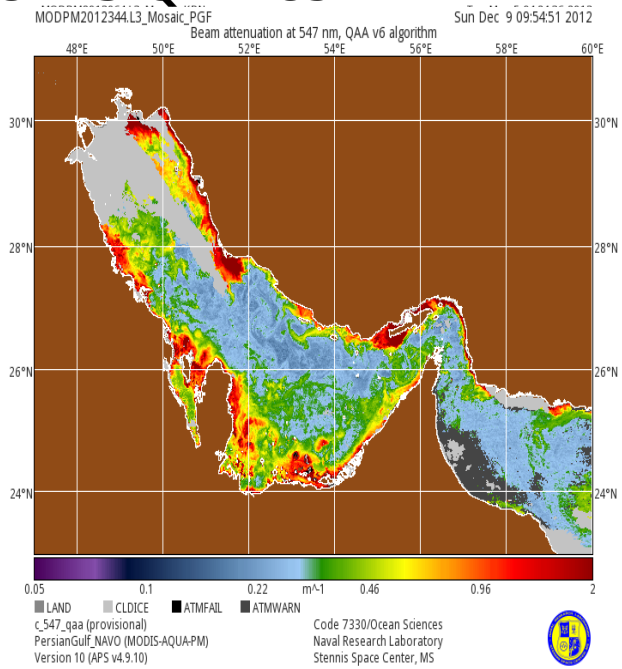

1
2
3


Persian Gulf - Julian Day 344 - Station 3
Filament
Absorption
Wavelength
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
400
450
500
550
600
650
700
MODIS a qaa
VIIRS v01 a qaa
VIIRS v02 a qaa
MODIS a lmi
VIIRS v01 a lmi
VIIRS v02 a lmi

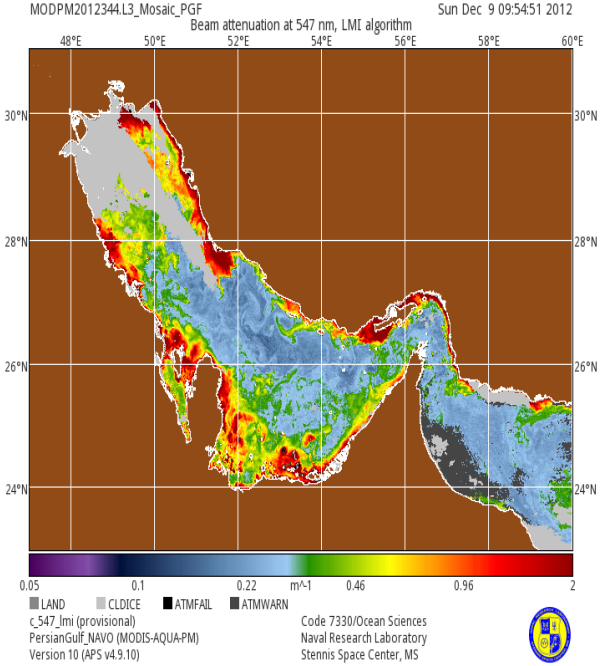

Persian Gulf - Julian Day 344 - Station 3
Filament
Backscattering
Wavelength
0.03
0.025
0.02
0.015
0.01
0.005
0
400
450
500
550
600
650
700
MODIS bb qaa
VIIRS v01 bb qaa
VIIRS v02 bb qaa
MODIS bb lmi
VIIRS v01 bb lmi
VIIRS v02 bb lmi

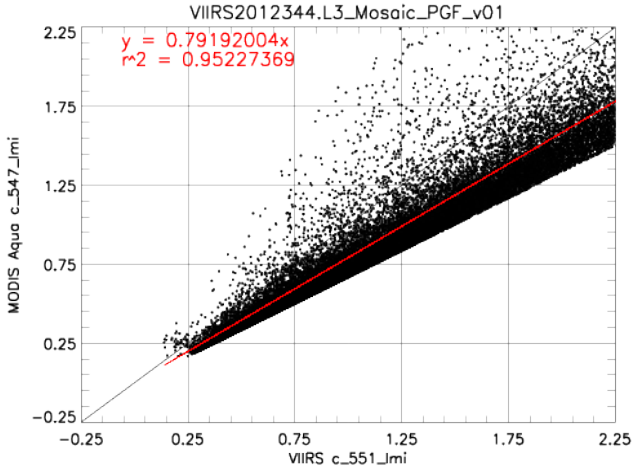

Persian Gulf - Julian Day 344 - Station 3
Filament
Beam-c
Wavelength
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700
08.8m
06.7m
07.3m
08.6m
05.3m
06.4m
VIIRS w/gains better both algorithms in comparison with MODIS.
MODIS c qaa
VIIRS v01 c qaa
VIIRS v02 c qaa
MODIS c lmi
VIIRS v01 c lmi
VIIRS v02 c lmi

# ODIS QAA c547

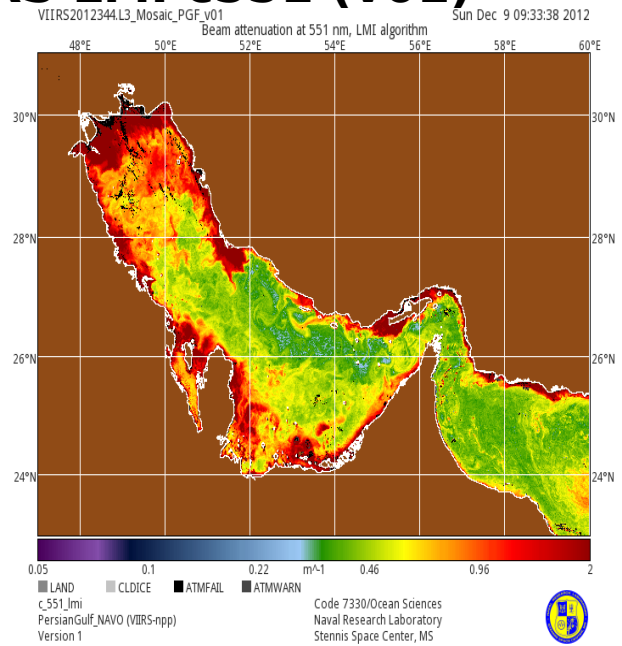



# MODIS LMI c547

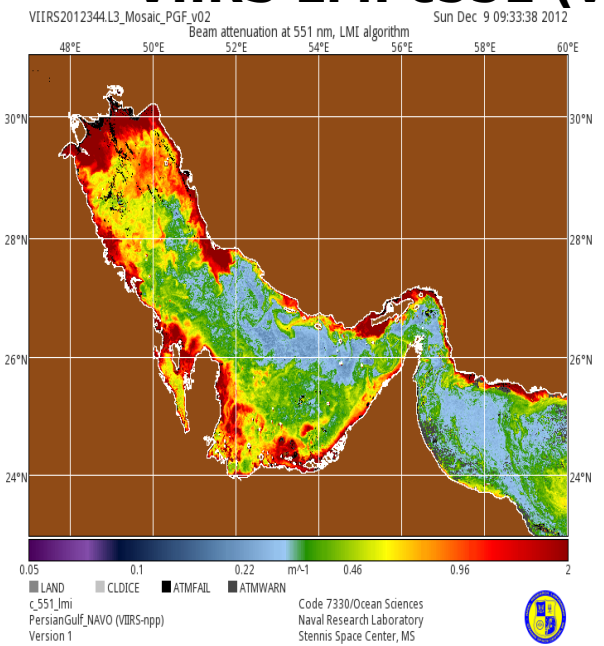


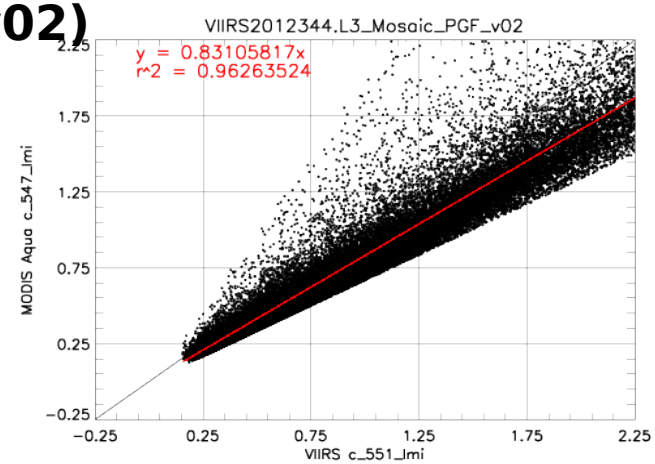




# RS LMI c551 (v01)




# VIIRS LMI c551 (v02)

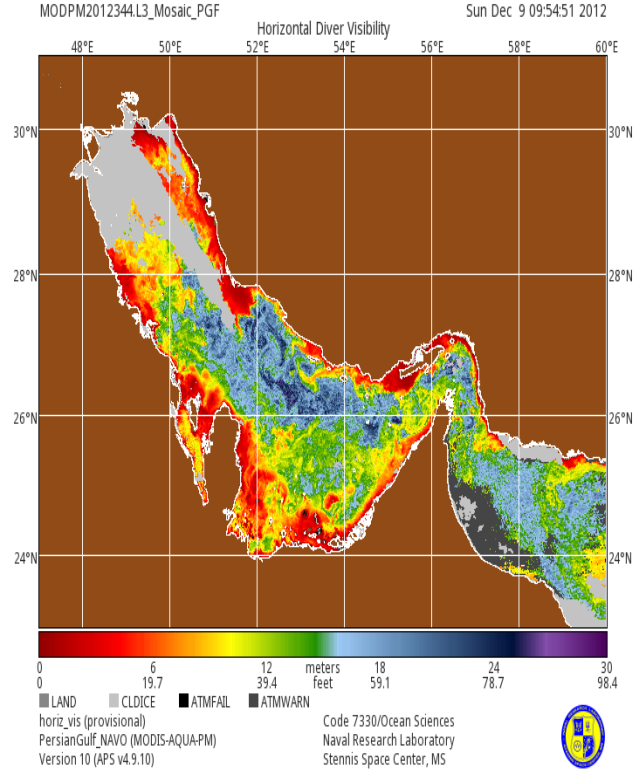


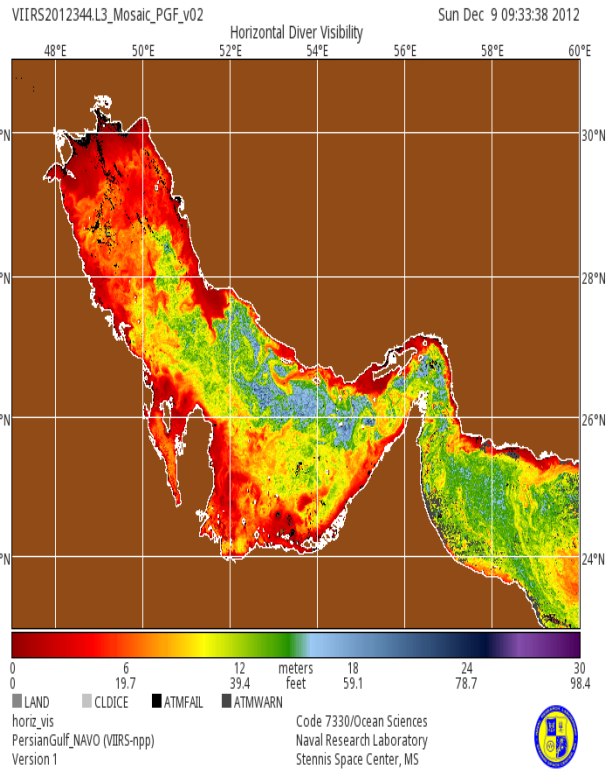



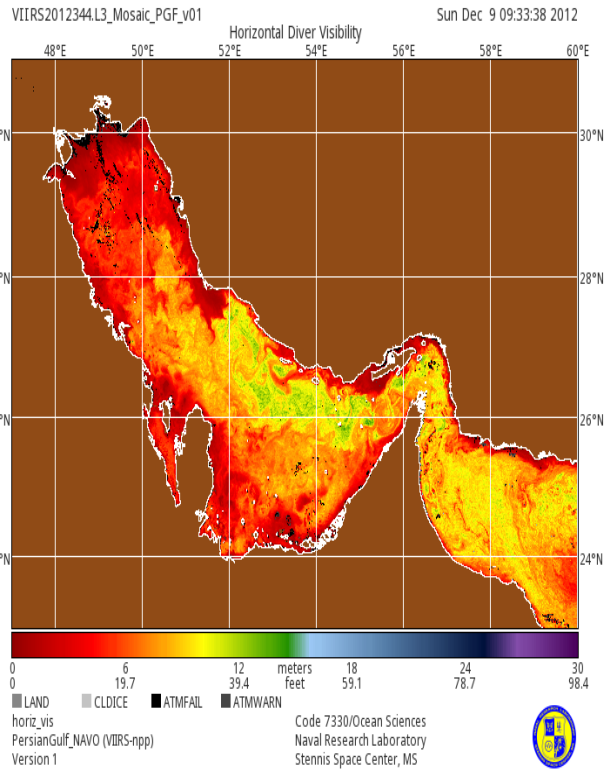
# DIS

# VIIRS (v02)

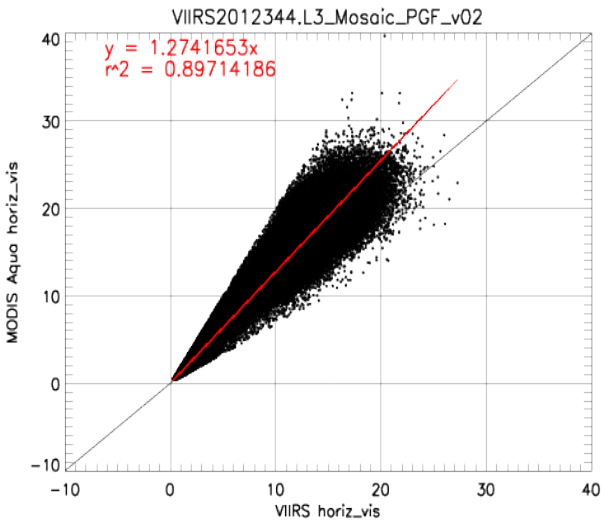
# VIIRS

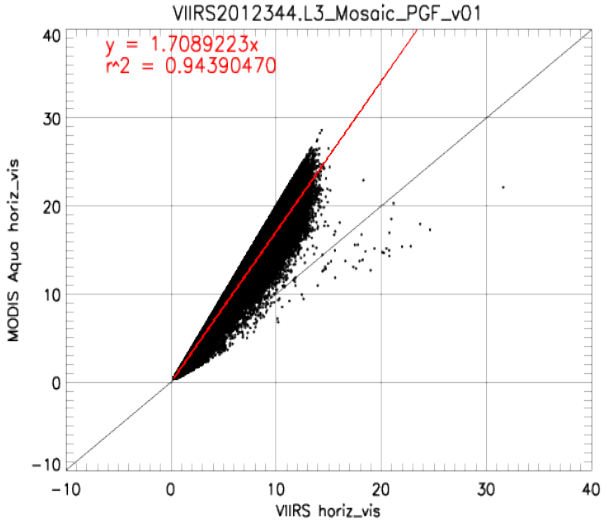



**HORIZONTAL VISIBILITY (LMI 531)**

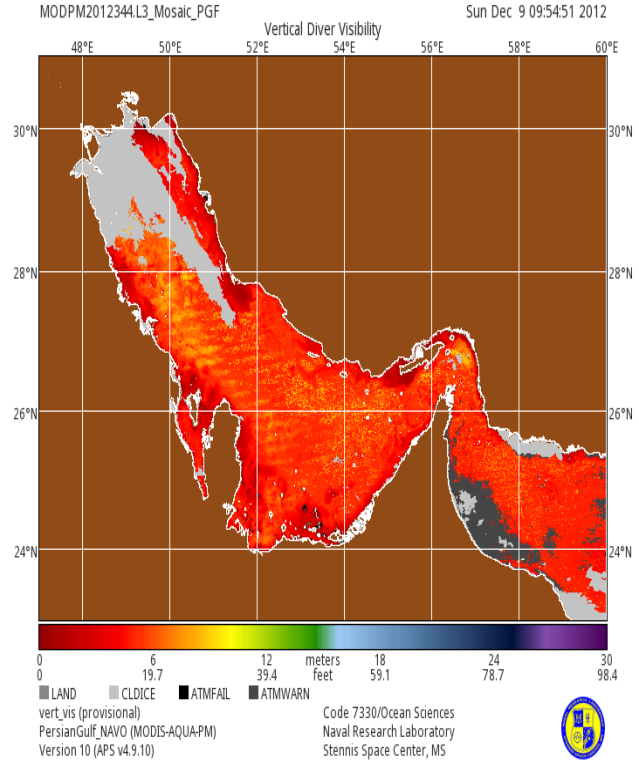


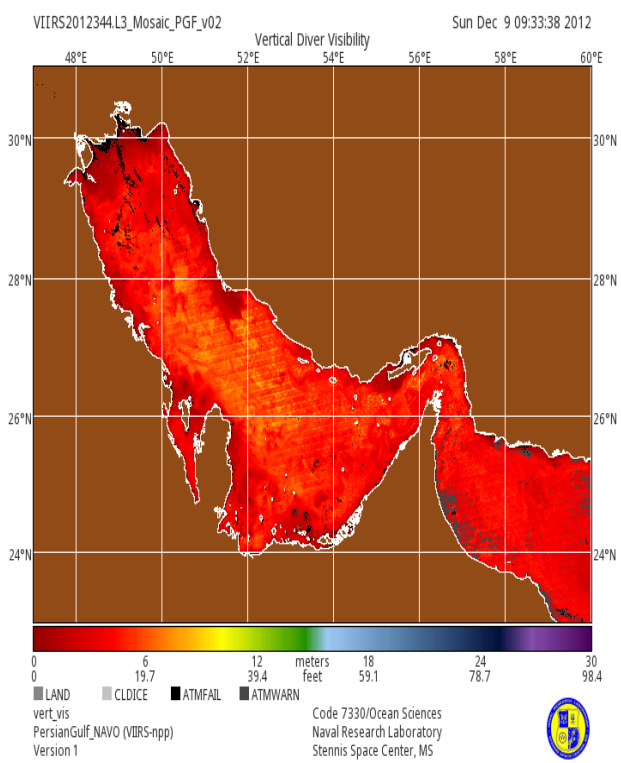



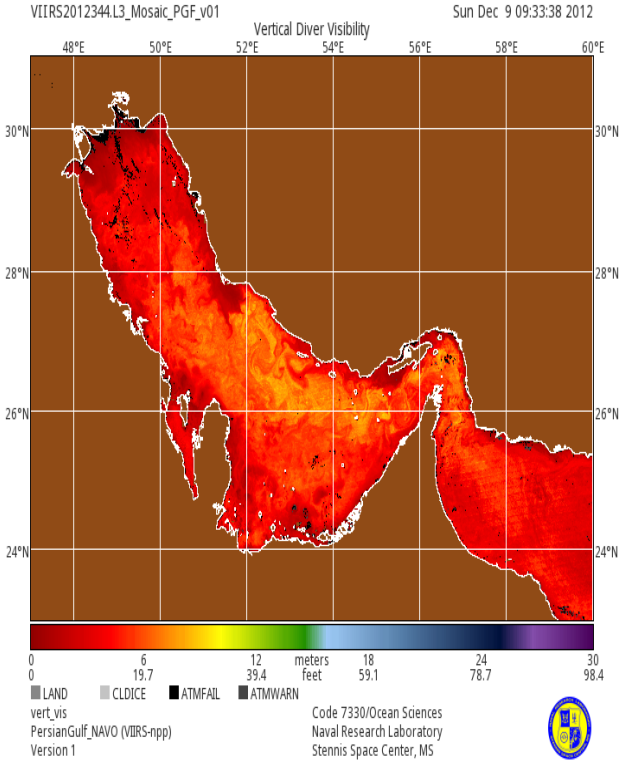
# DIS

# VIIRS (v02)

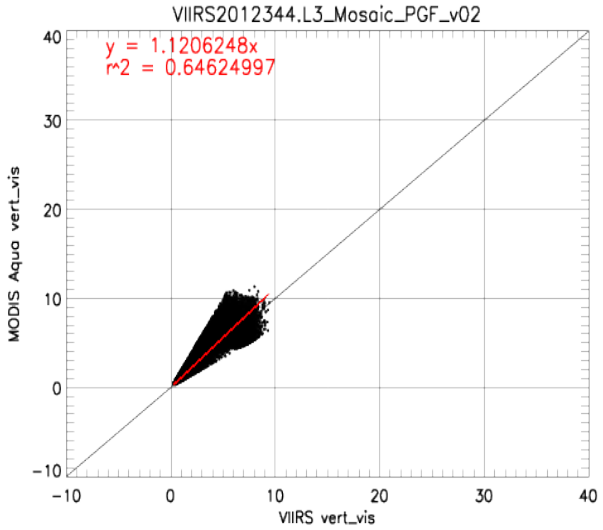
# VIIRS

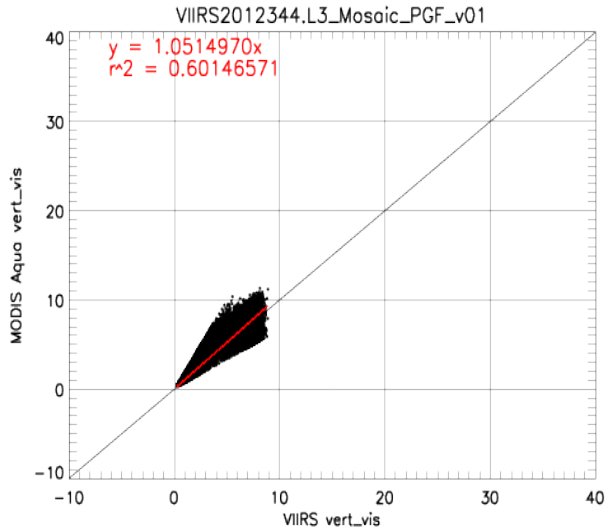


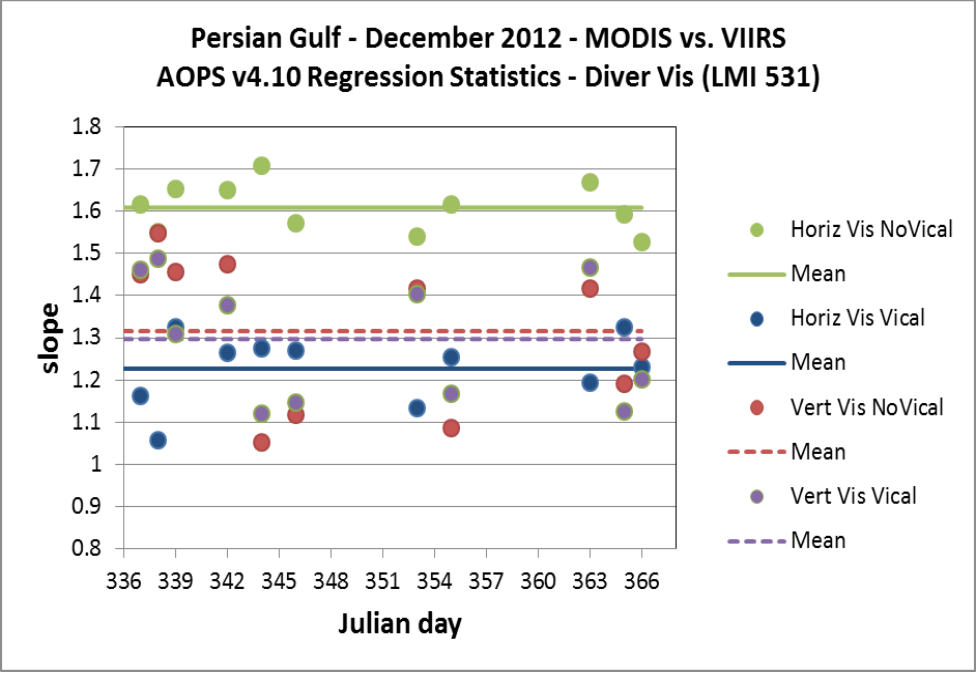



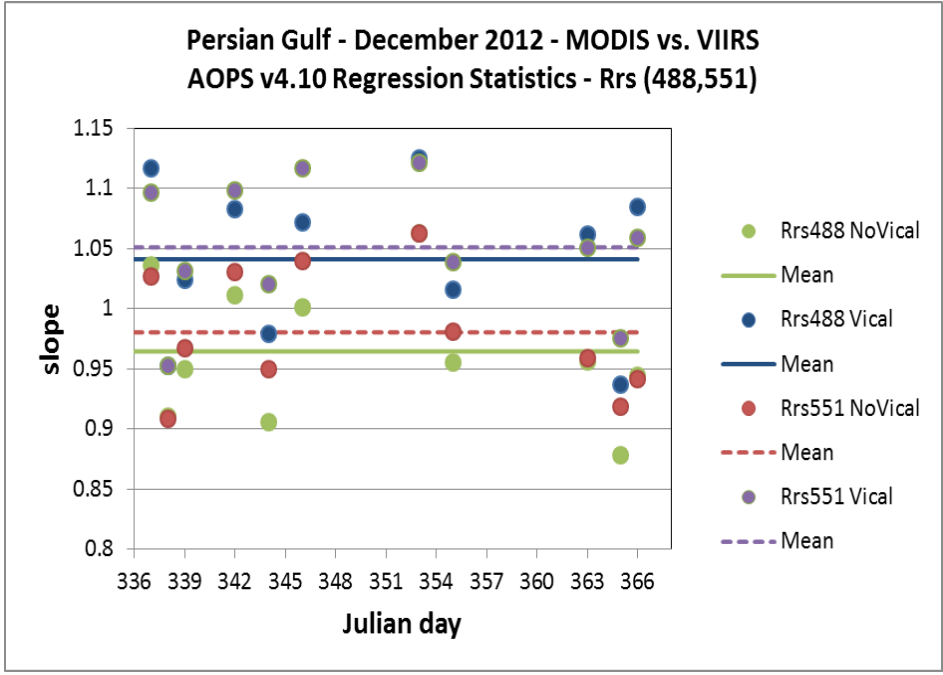



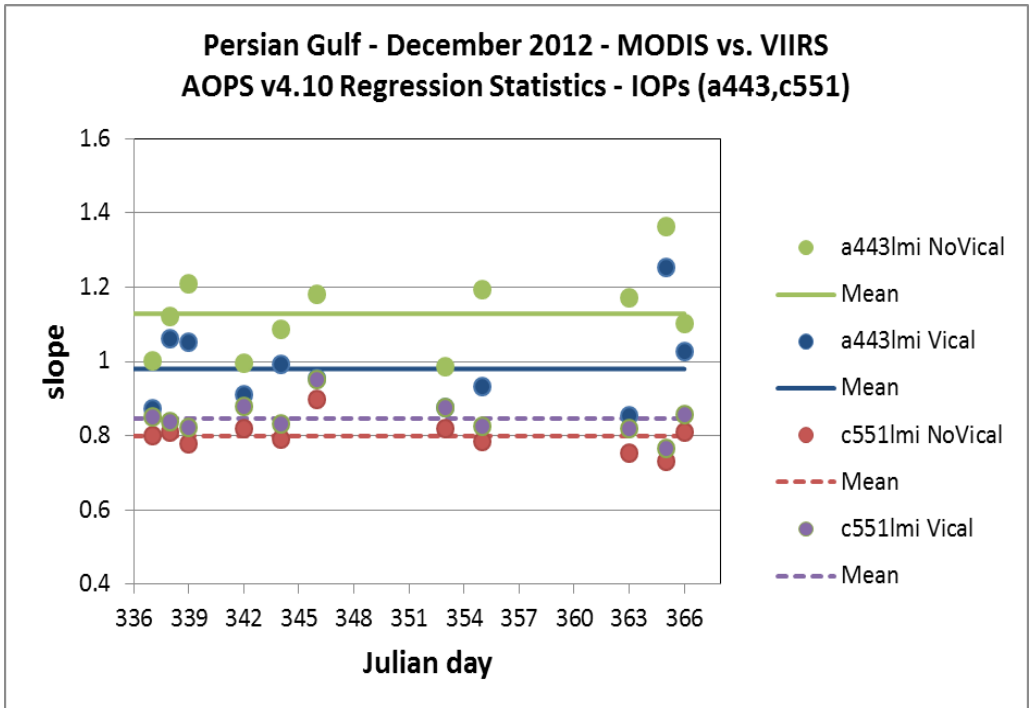

## VERTICAL VISIBILITY (LMI 531)



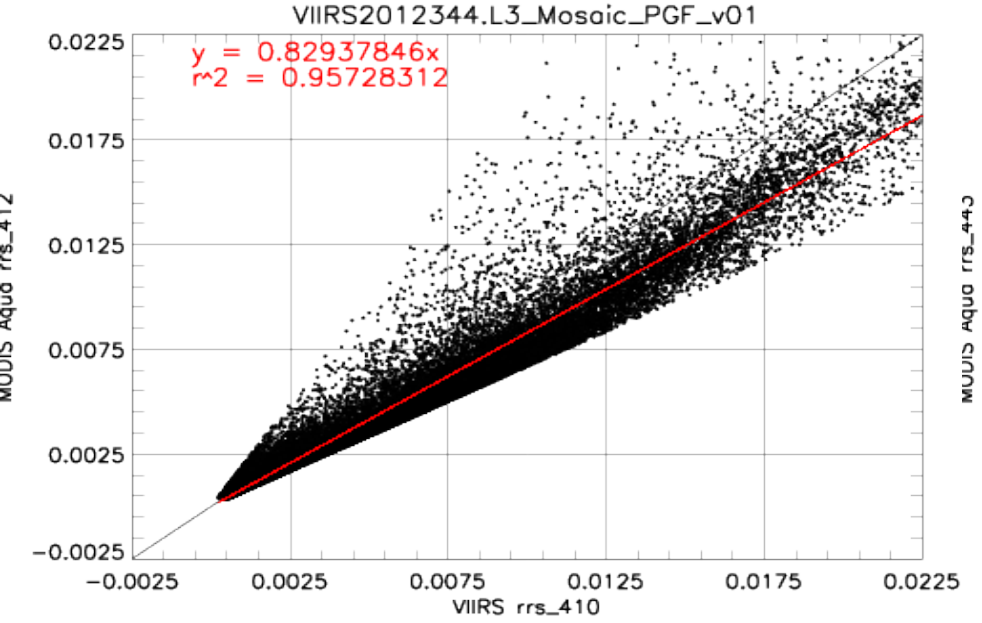



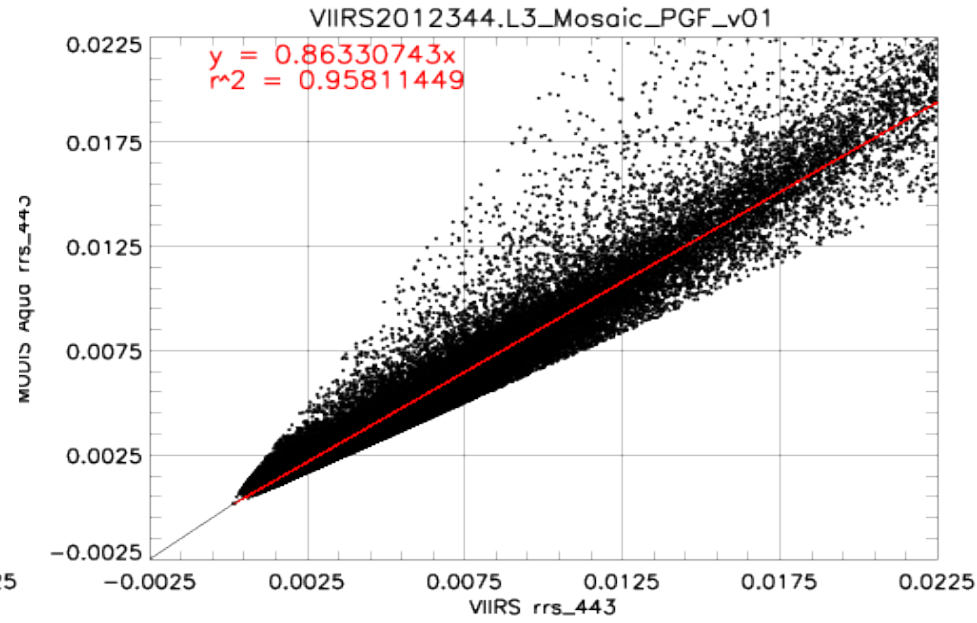

Persian Gulf - December 2012 - MODIS vs. VIIRS
AOPS v4.10 Regression Statistics - Diver Vis (LMI 531)
slope
Julian day
Horiz Vis NoVical
Mean
Horiz Vis Vical
Mean
Vert Vis NoVical
Mean
Vert Vis Vical
Mean

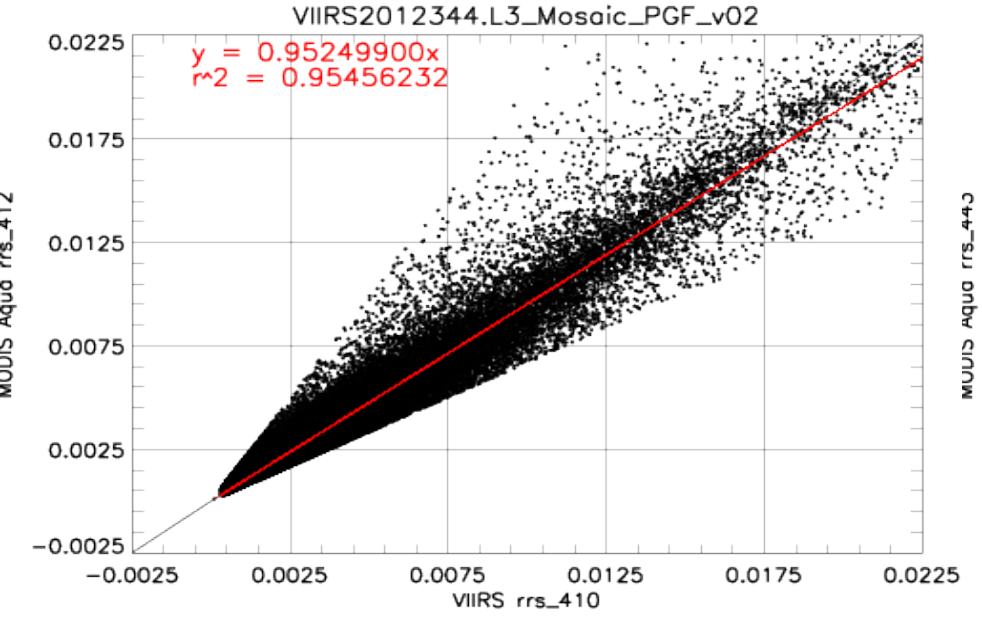

Persian Gulf - December 2012 - MODIS vs. VIIRS
AOPS v4.10 Regression Statistics - Rrs (488,551)
slope
Julian day
Rrs488 NoVical
Mean
Rrs488 Vical
Mean
Rrs551 NoVical
Mean
Rrs551 Vical
Mean

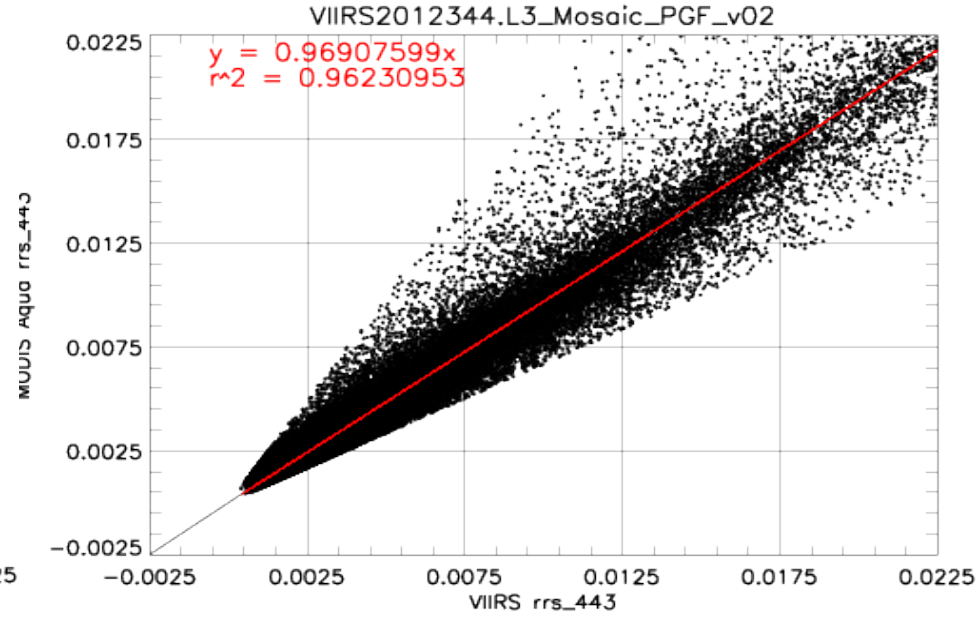

Persian Gulf - December 2012 - MODIS vs. VIIRS
AOPS v4.10 Regression Statistics - IOPs (a443,c551)
slope
Julian day
a443lmi NoVical
Mean
a443lmi Vical
Mean
c551lmi NoVical
Mean
c551lmi Vical
Mean

# Rrs Matchup MODIS vs. VIIRS (412,443)

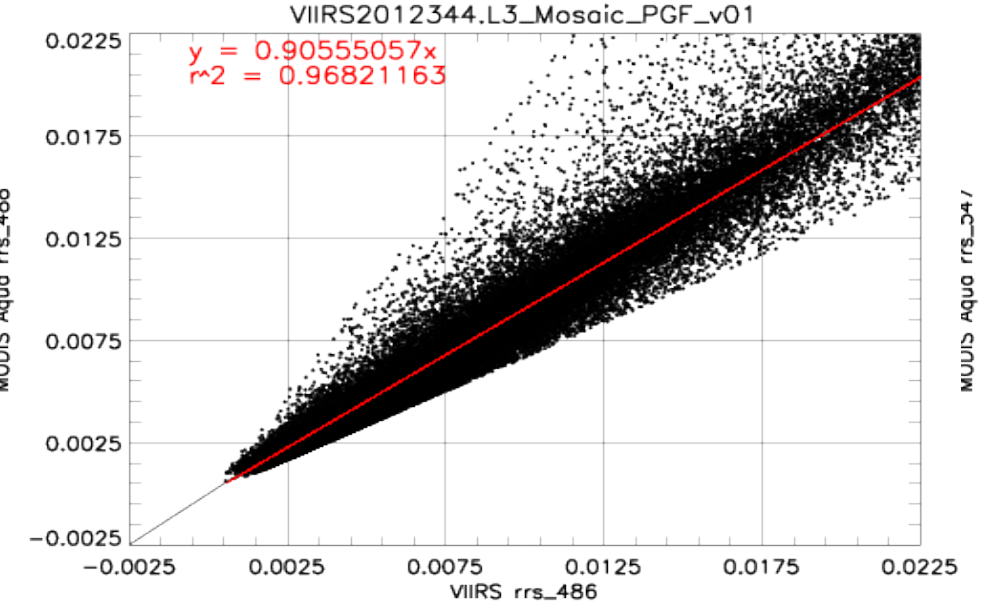


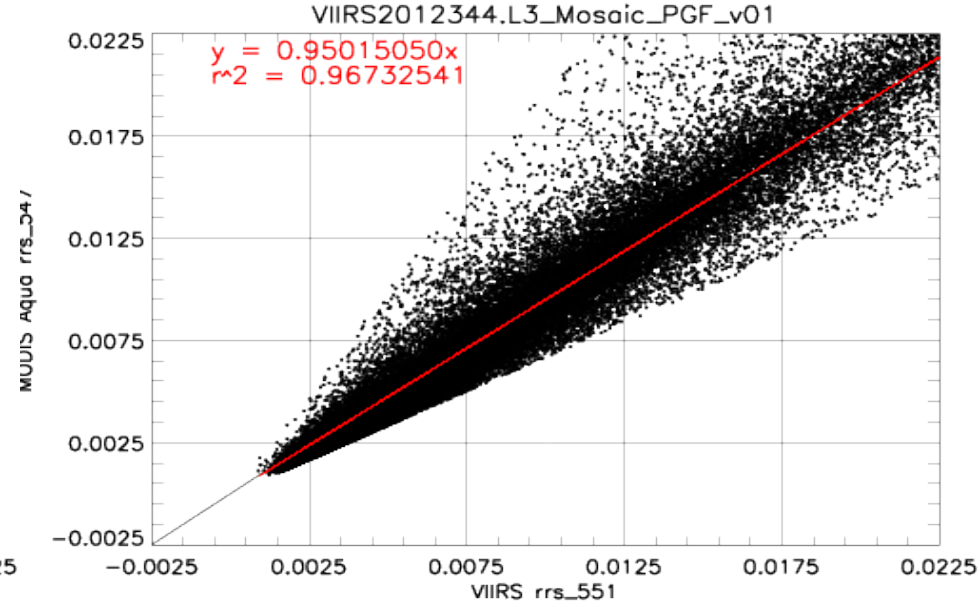



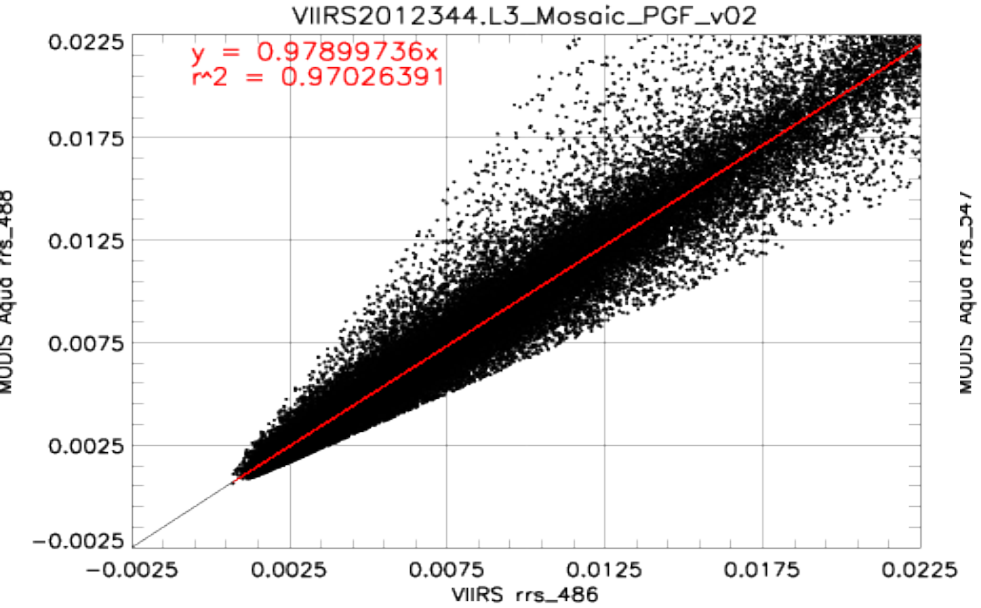



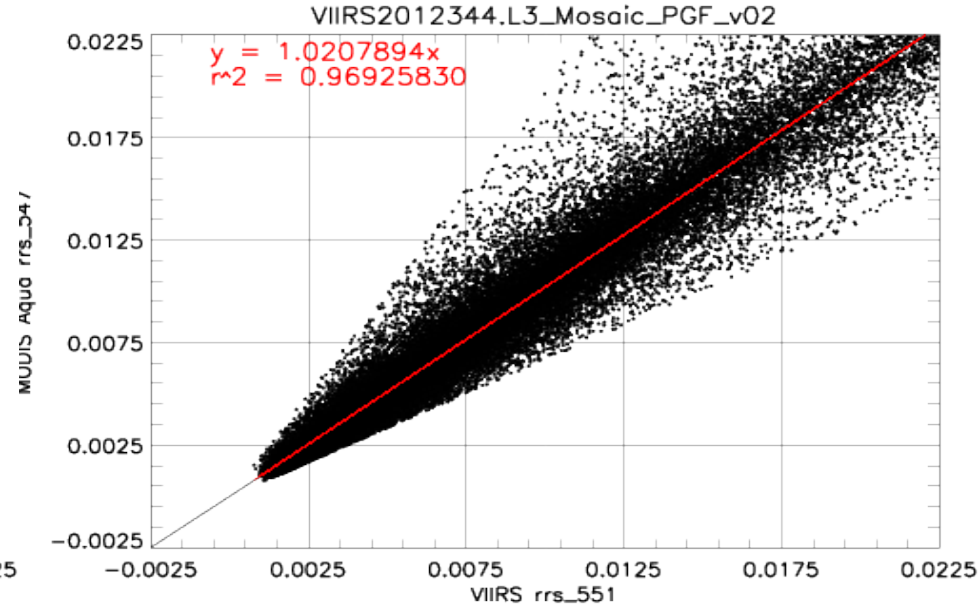



# Rrs Matchup MODIS vs. VIIRS (488,451)

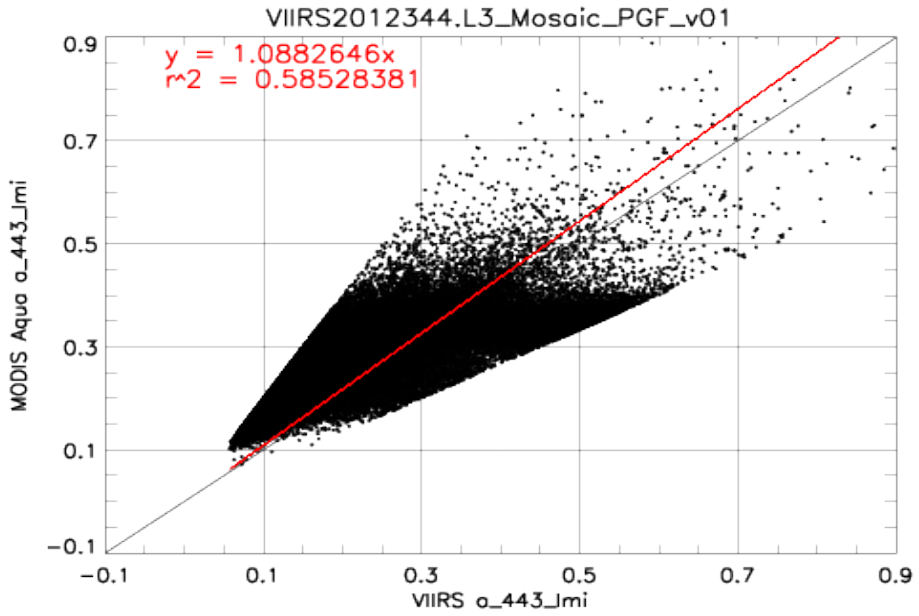


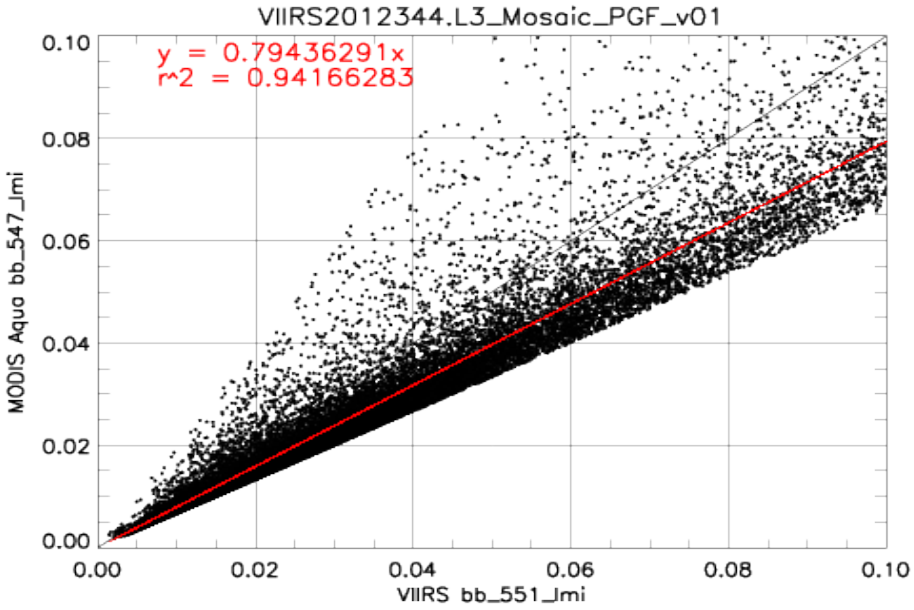



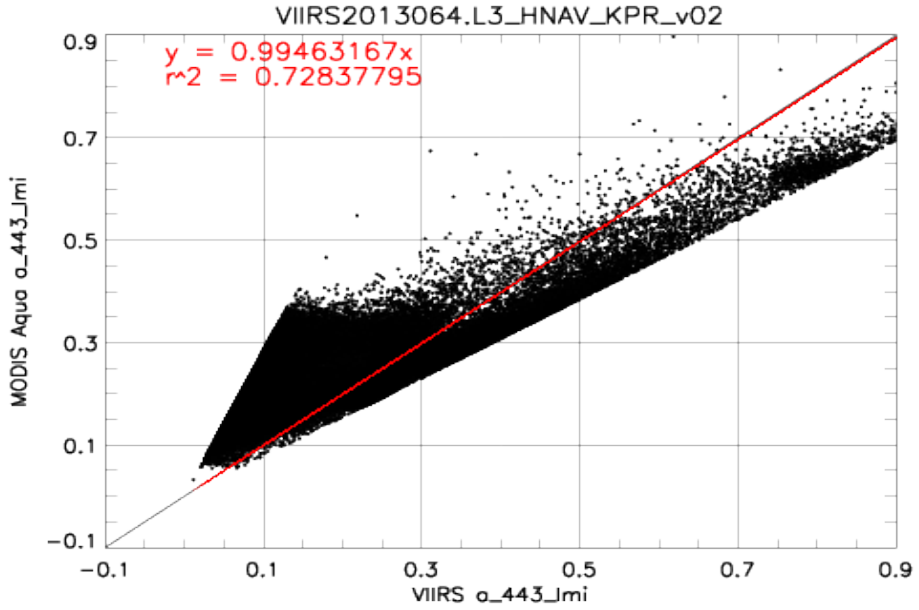



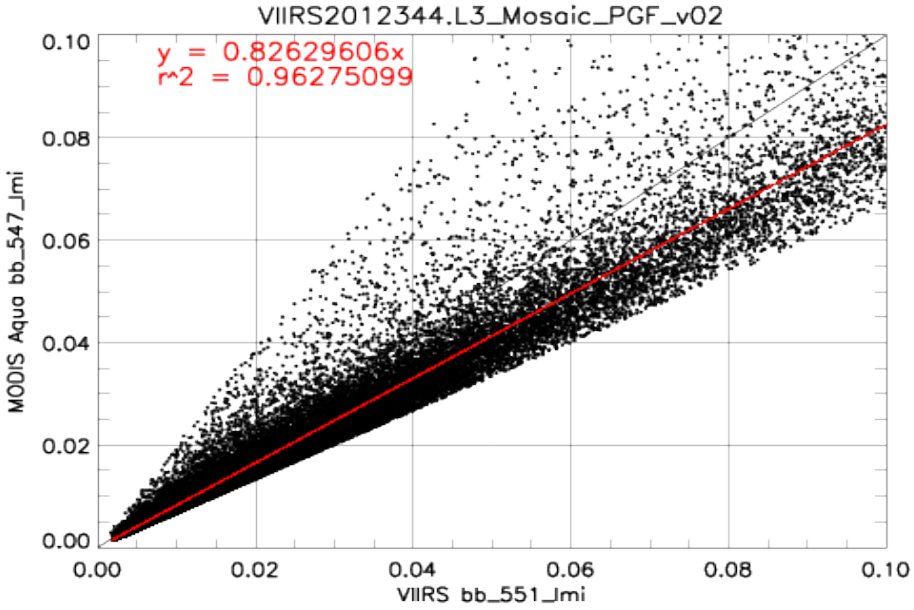



# a,bb Matchup MODIS vs. VIIRS

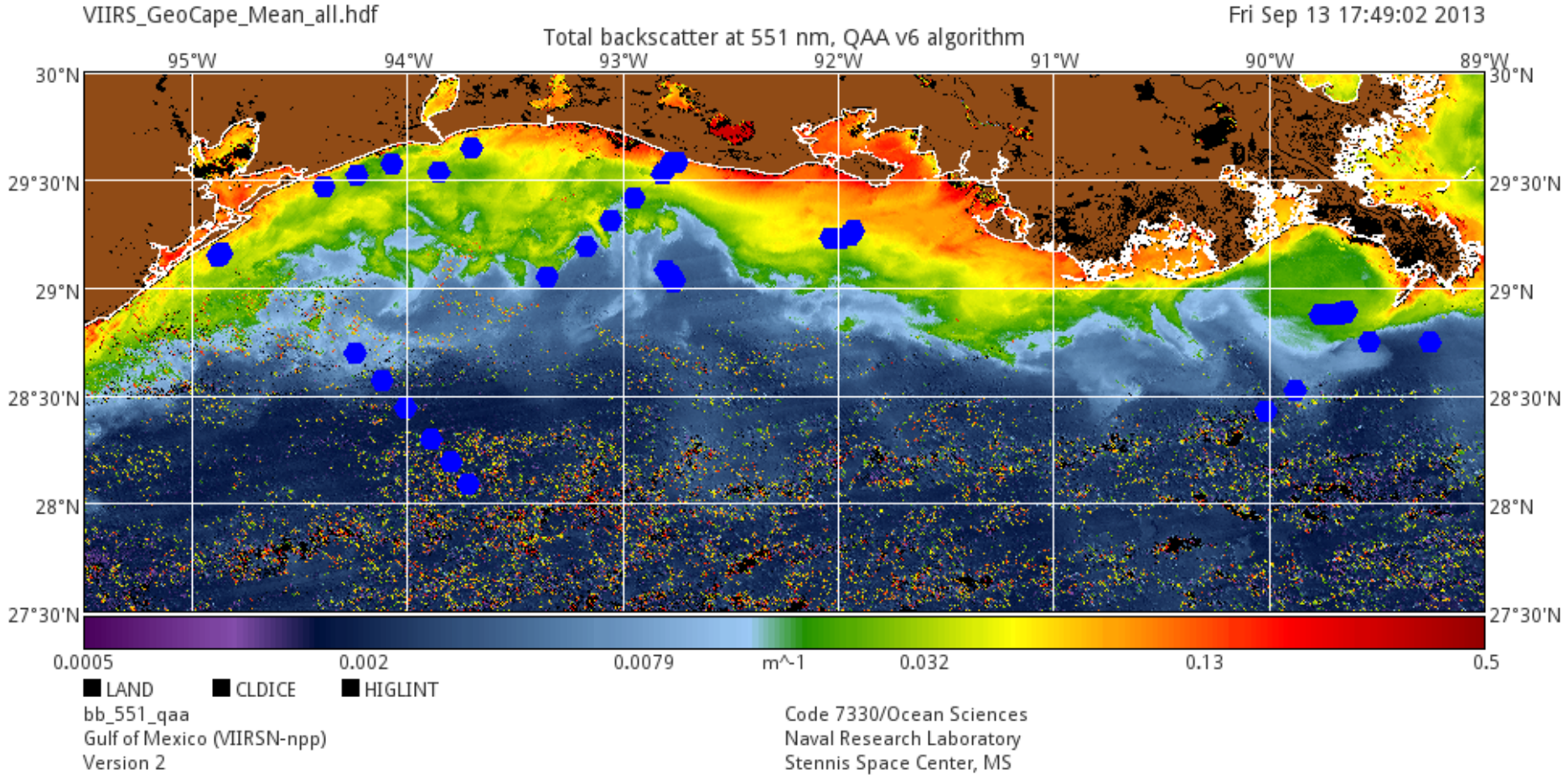


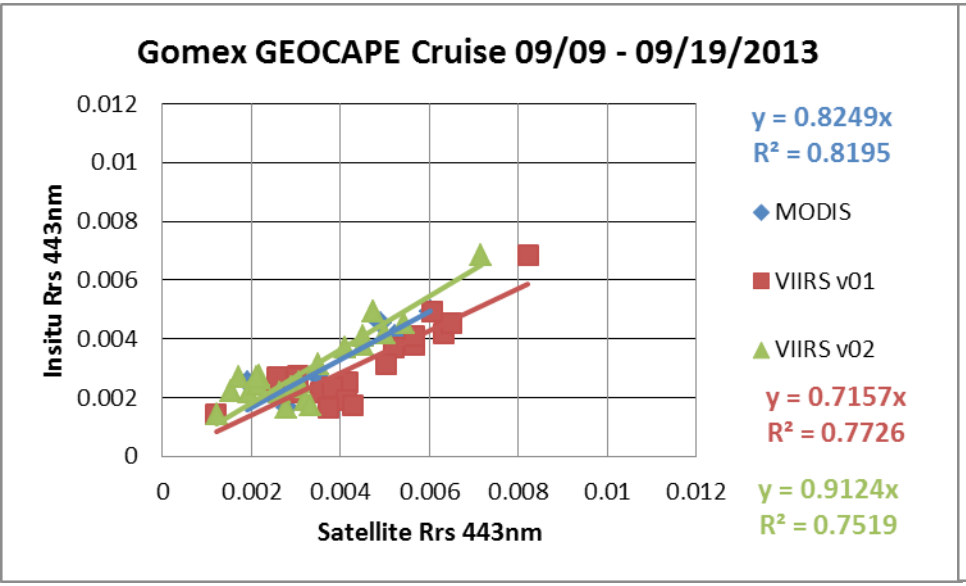



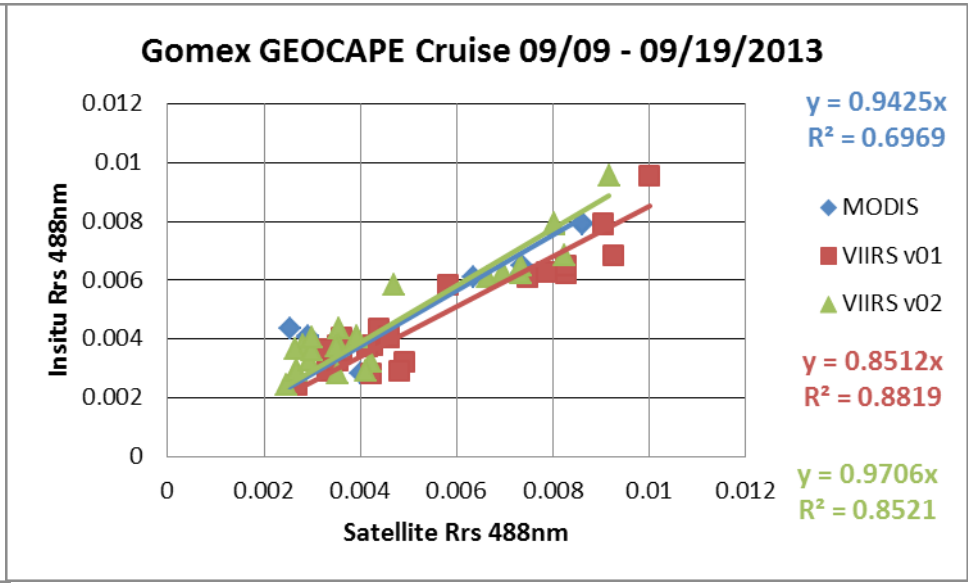
# GEOCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013
# Rrs and IOP Station Locations

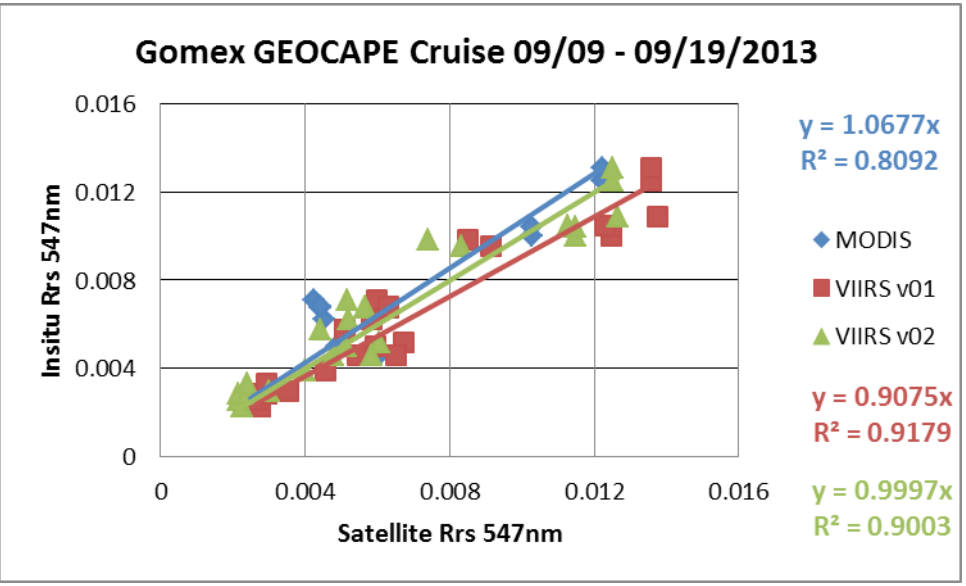



**Insitu: UMASS/NOAA**

# GEOCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013 - Scat



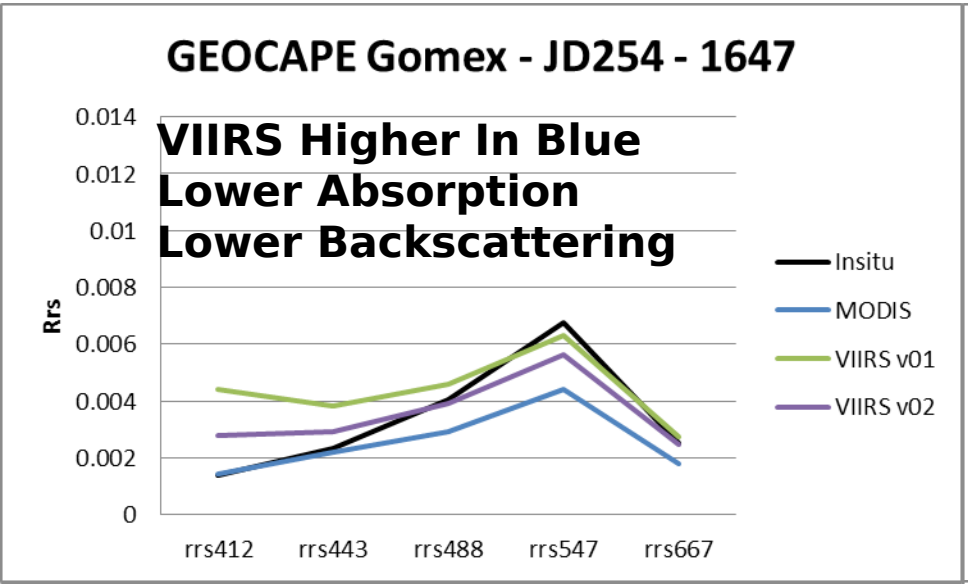

| Slope | rrs412 | rrs443 | rrs488 | rrs547 |
|---|---|---|---|---|
| MODIS | 0.85 | 0.82 | 0.94 | 1.07 |
| VIIRS v01 | 0.5 | 0.72 | 0.85 | 0.91 |
| VIIRS v02 | 0.79 | 0.91 | 0.97 | 0.99 |

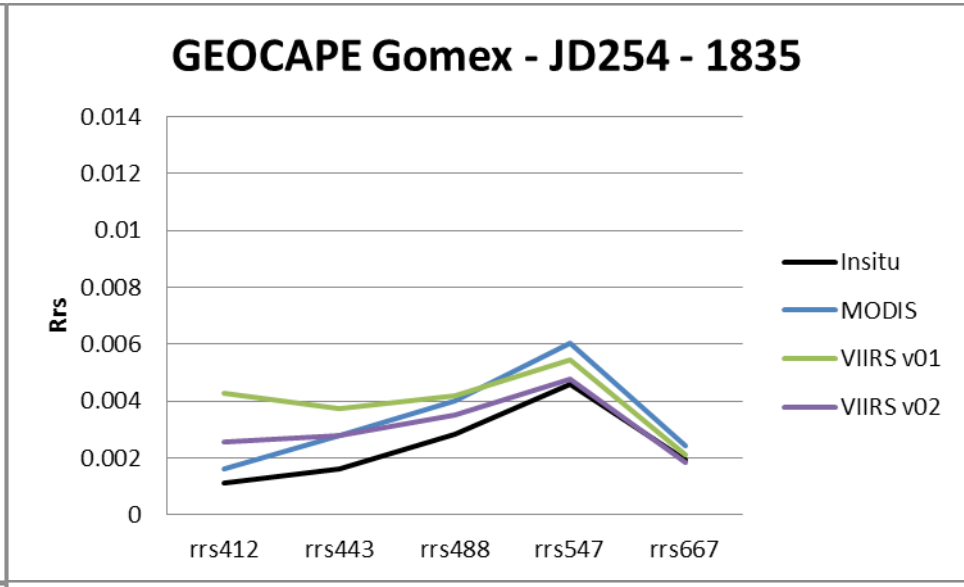
| Rsquared | rrs412 | rrs443 | rrs488 | rrs547 |
|---|---|---|---|---|
| MODIS | 0.91 | 0.86 | 0.85 | 0.86 |
| VIIRS v01 | 0.44 | 0.77 | 0.89 | 0.92 |
| VIIRS v02 | 0.40 | 0.78 | 0.88 | 0.92 |

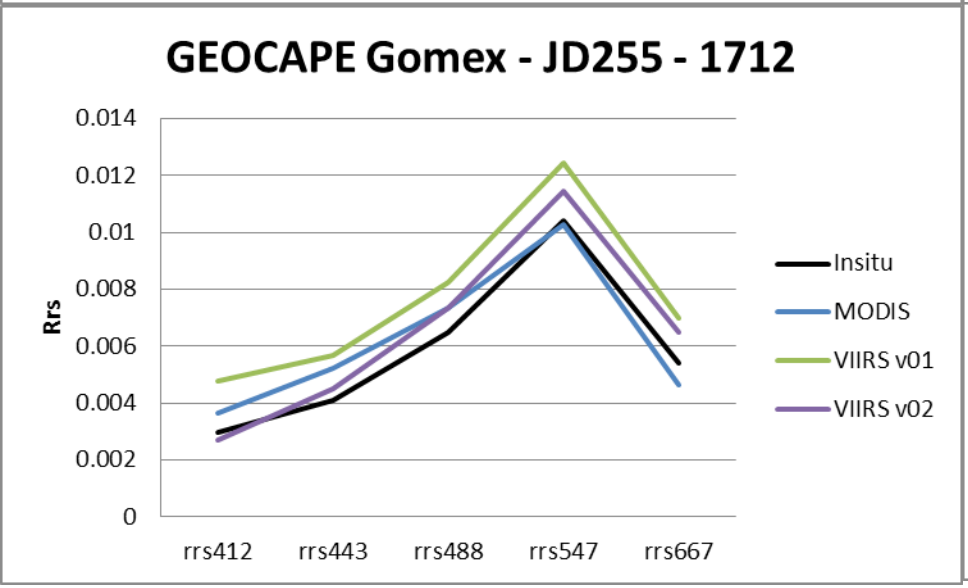
**Insitu: UMASS/NOAA**

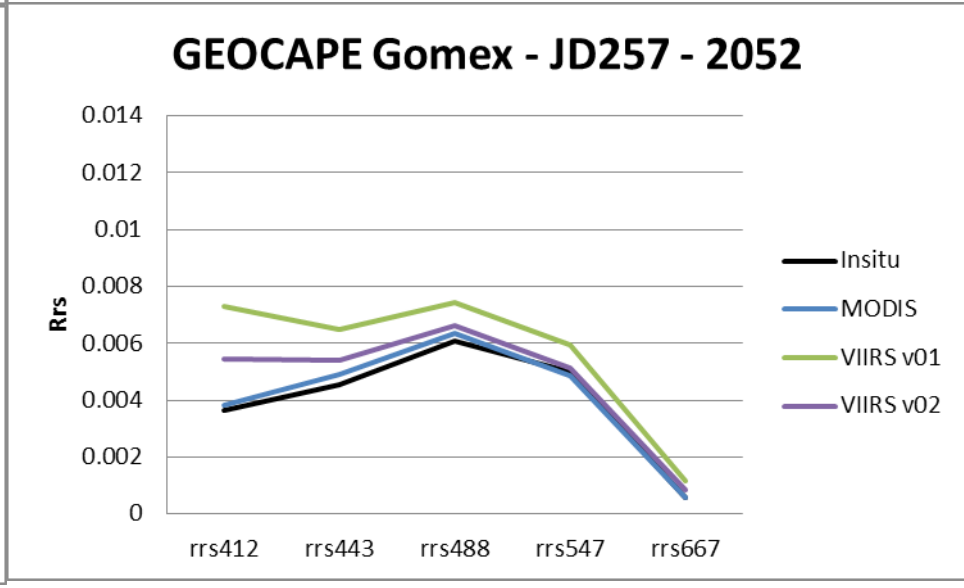
**VIIRS Blue Issue**

# EOCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013 - Spectr



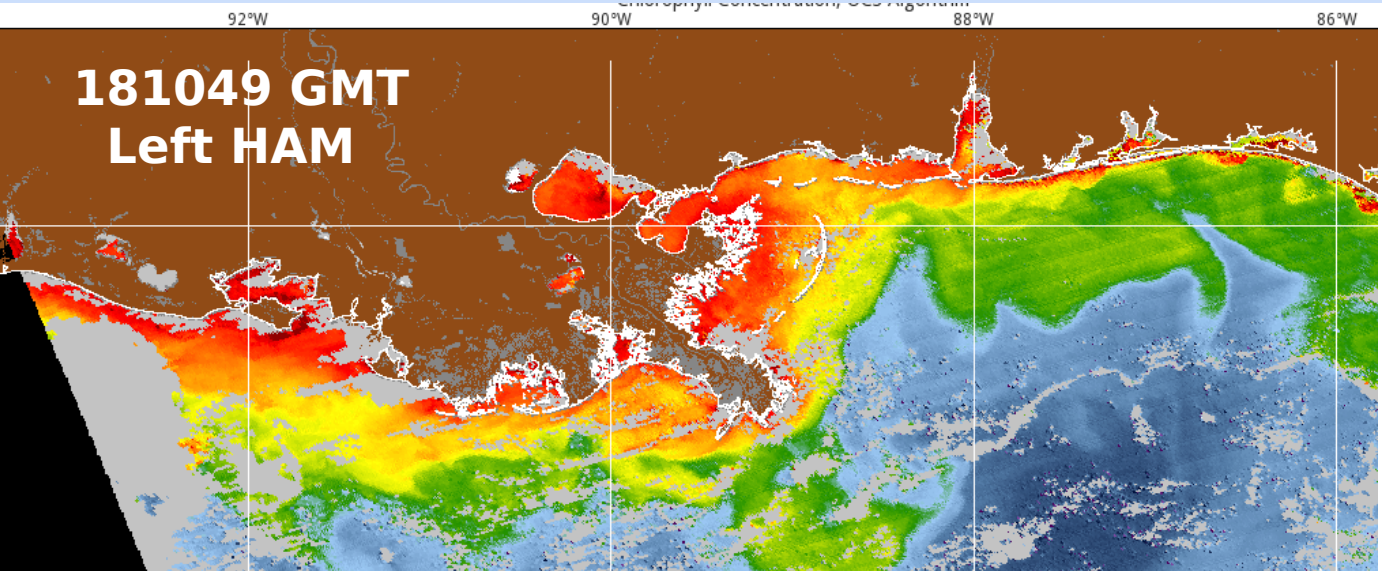



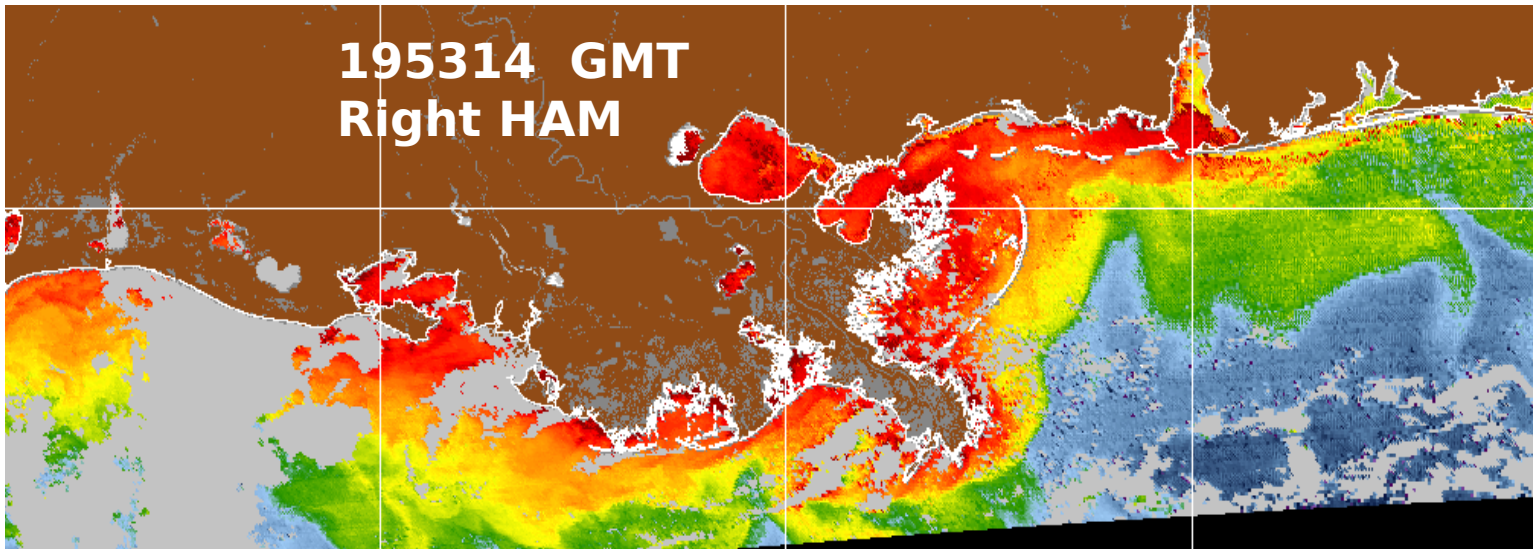




**Insitu: UMASS/NOAA**

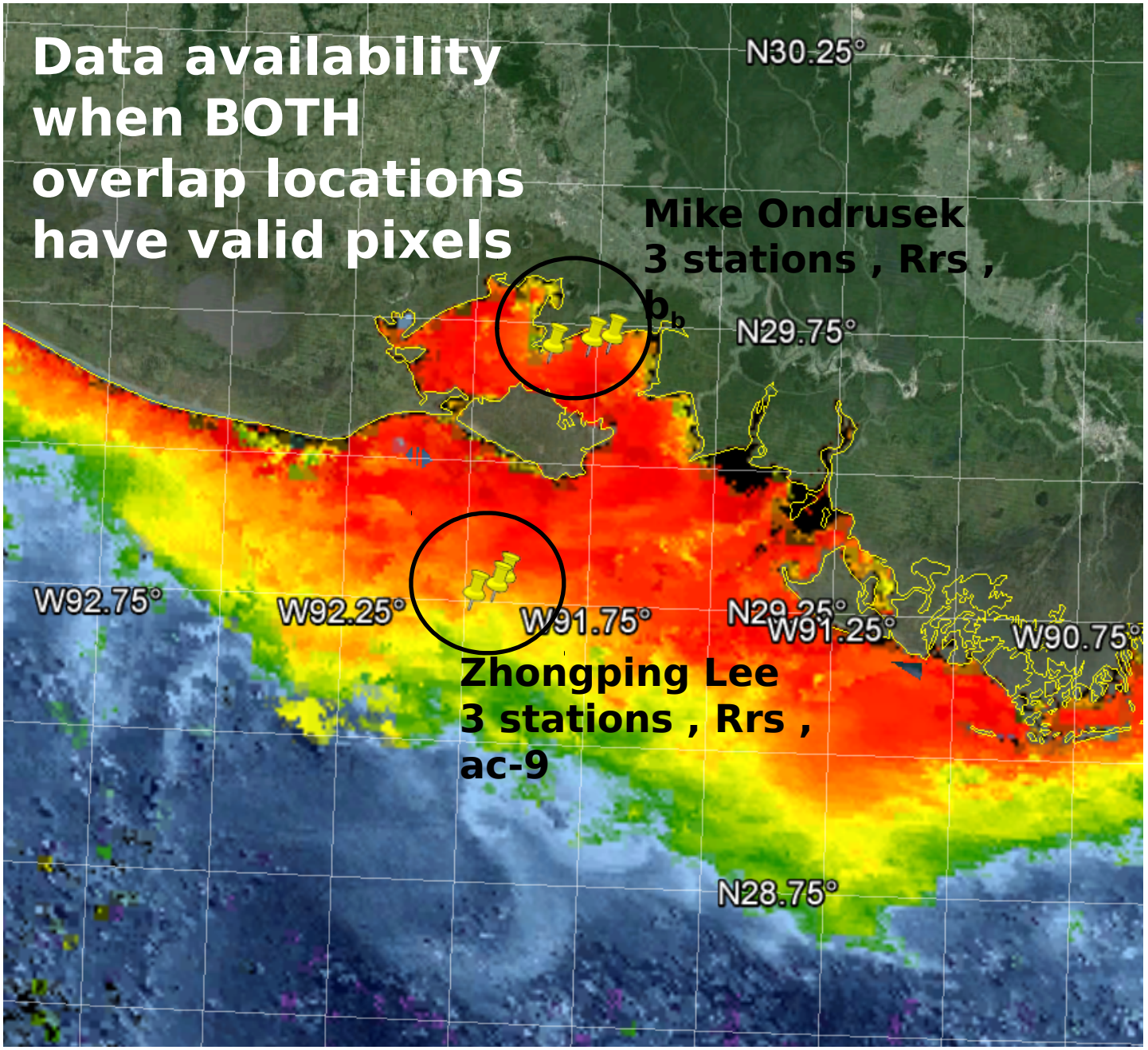
# Validation and Ocean Color Uncertainty
# Sept 12 , 2013 - NPP –VIIRS Orbital Overlap

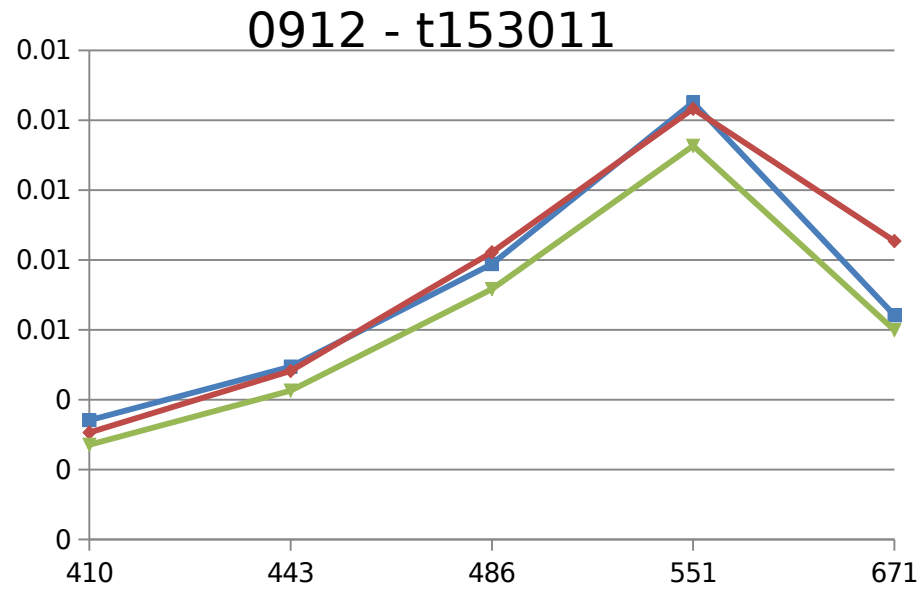


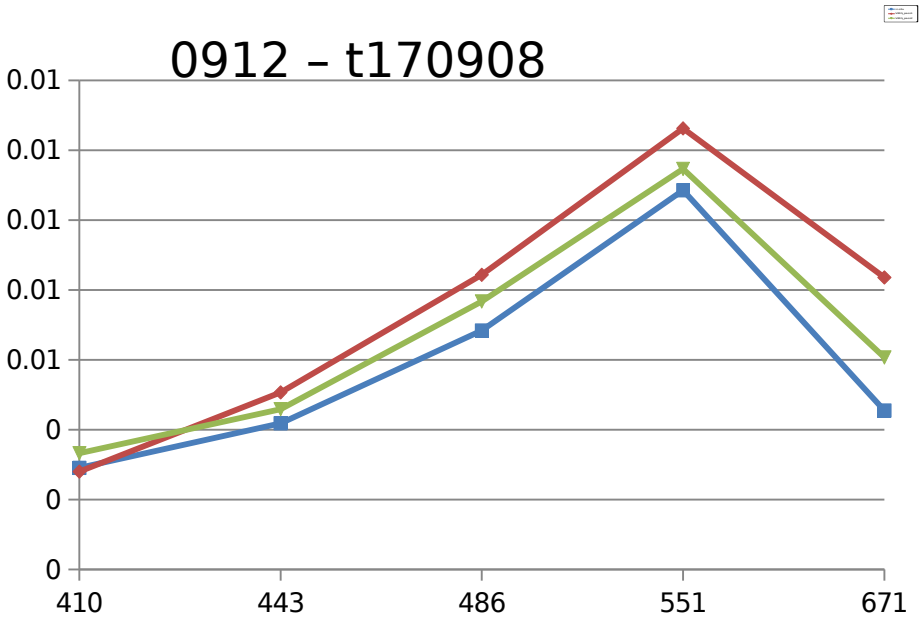

**00 Minutes separation between orbital overlap – left and right side of s**

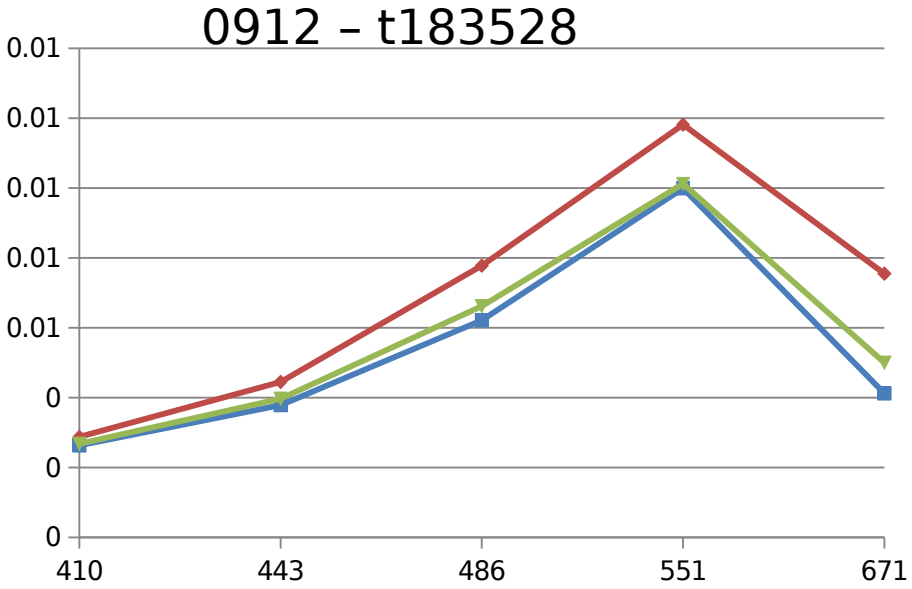
What is the product uncertainty between these NPP products?

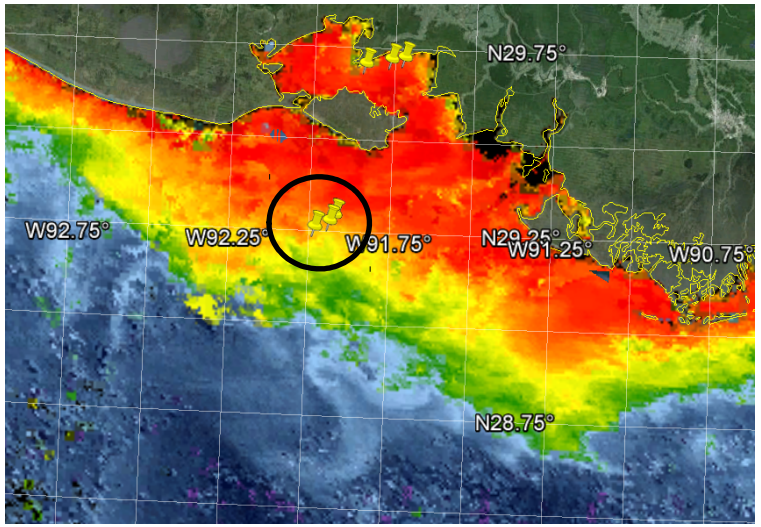

Data availability when BOTH overlap locations have valid pixels
Mike Ondrusek 3 stations , Rrs , $b_b$
Zhongping Lee 3 stations , Rrs , ac-9
N30.25°
N29.75°
N29.25°
N28.75°
W92.75°
W92.25°
W91.75°
W91.25°
W90.75°

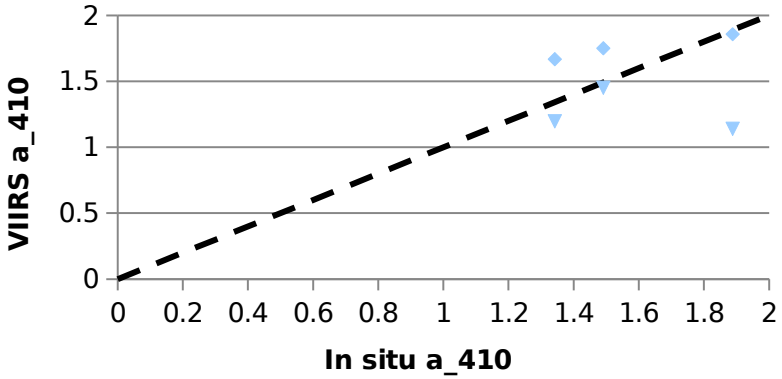


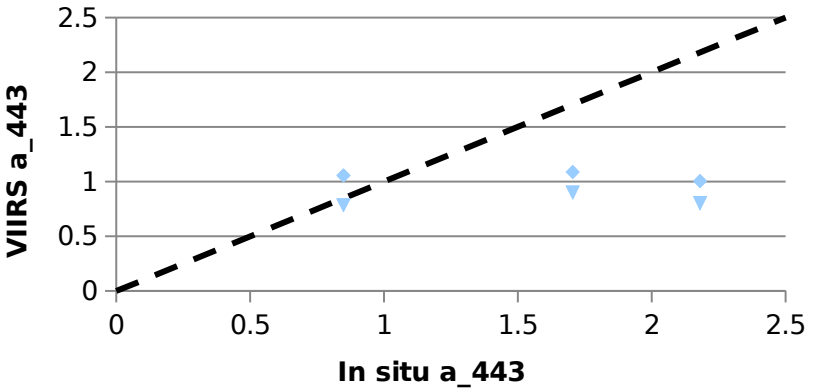

**Zhongping Lee, rrs**

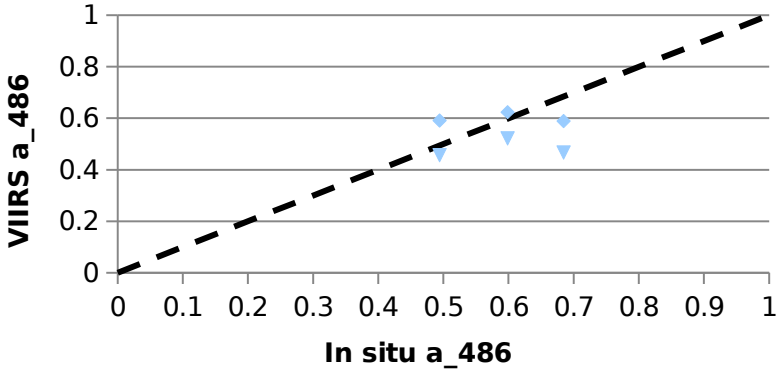


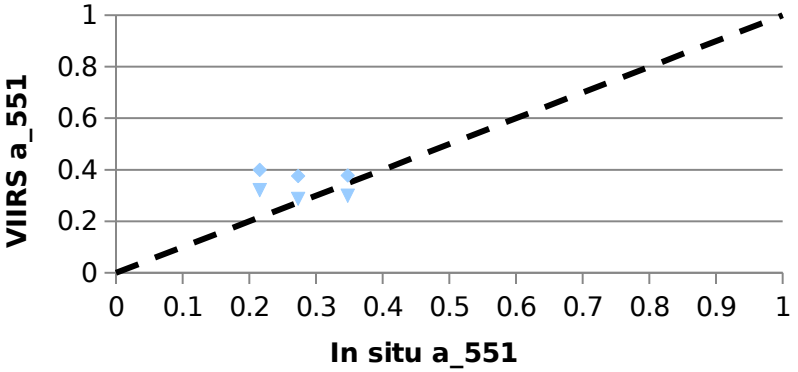





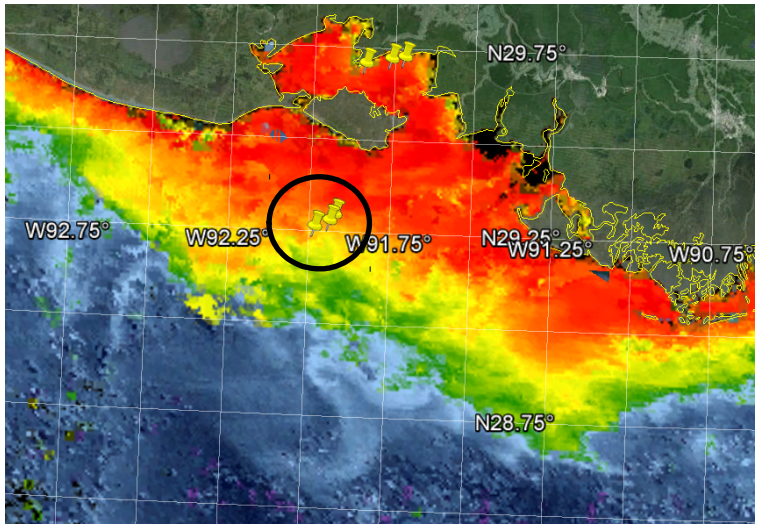



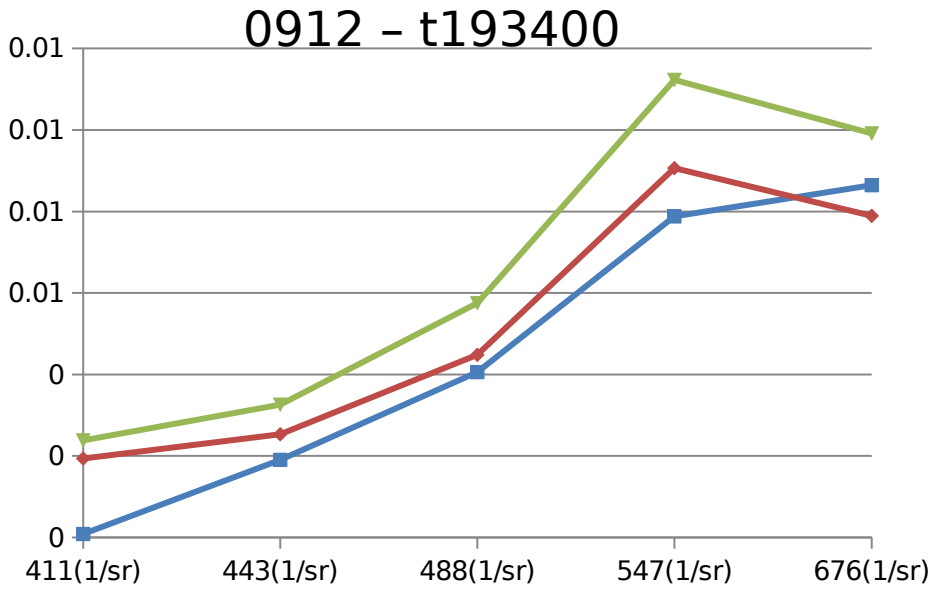



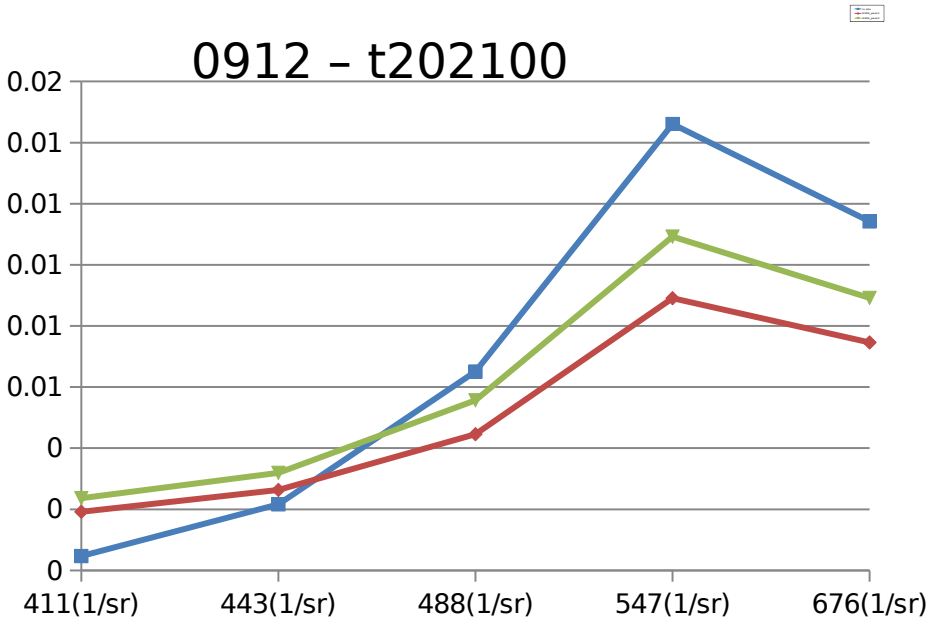

**Zhongping Lee,**
**ac-9**

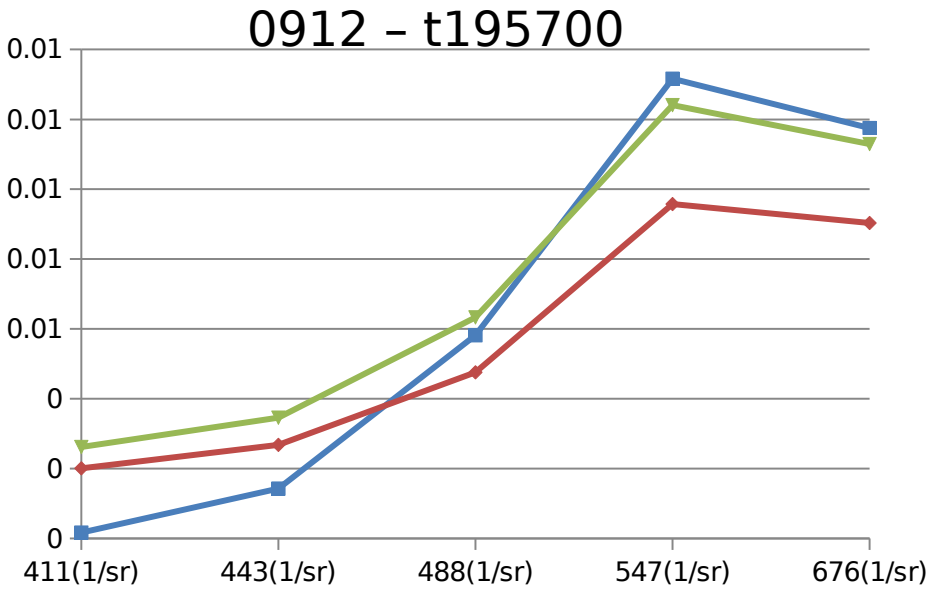
**Overlap**
**comparison**

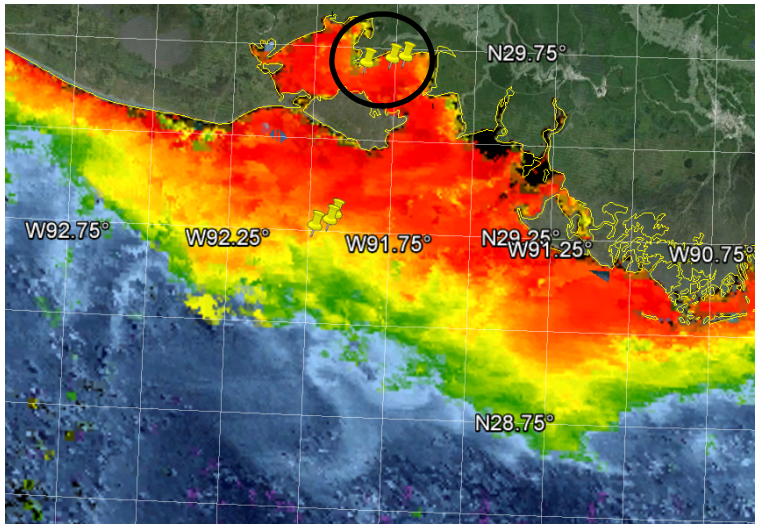




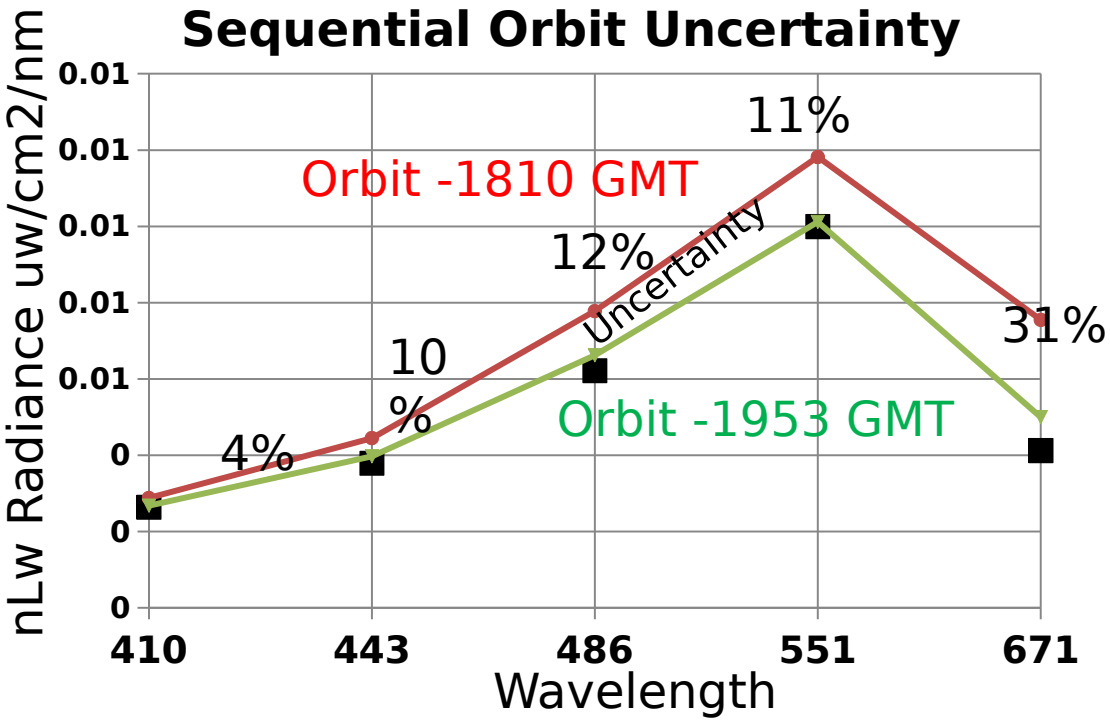

**Mike Ondrusek, rrs**

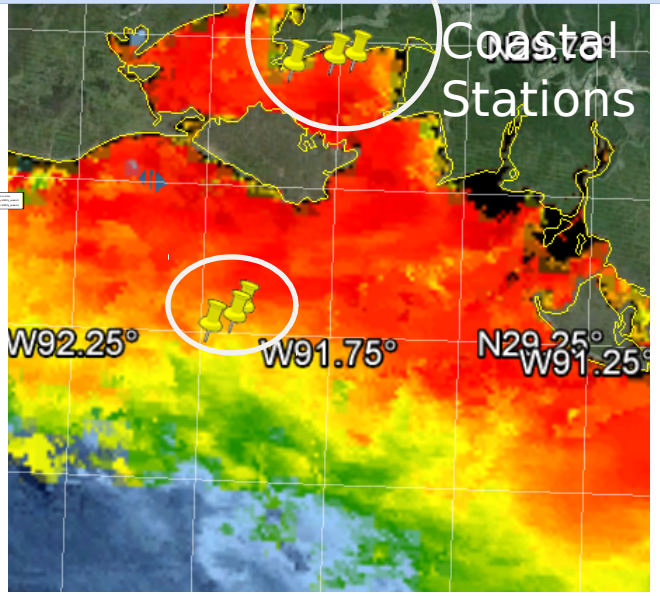


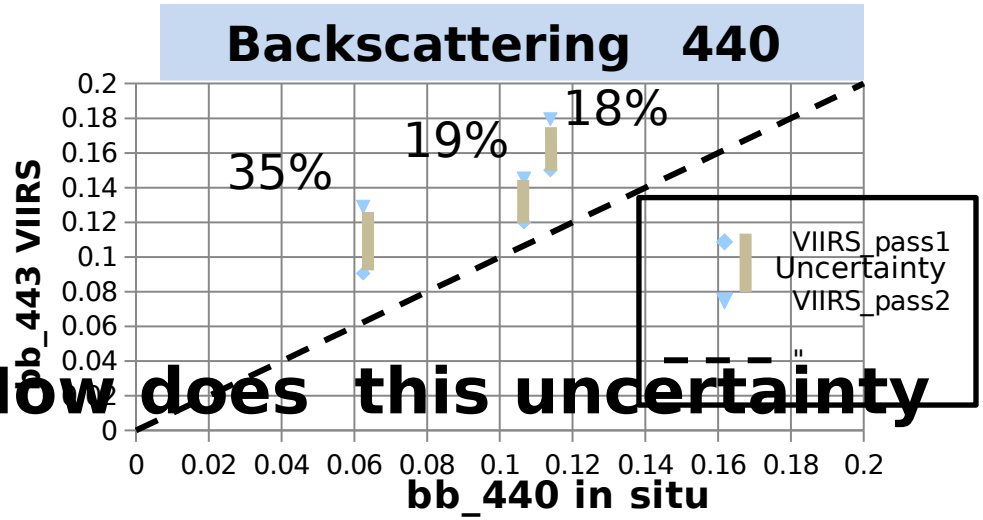



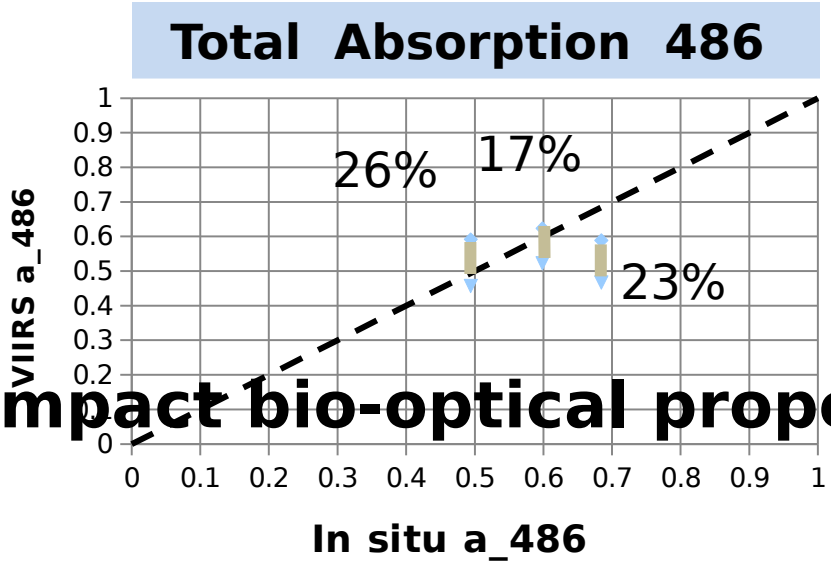



# NPP-VIIRS validation using Orbital OverLap –Sept 12, 2013 - Northern Gulf



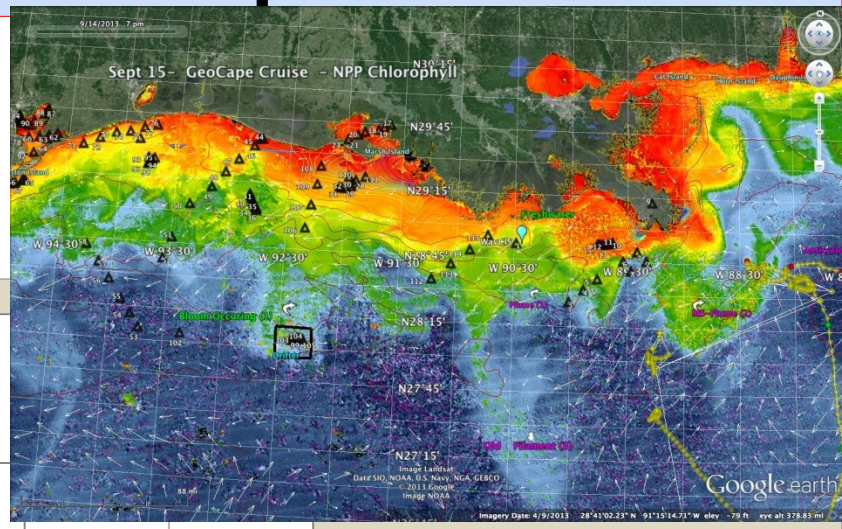




**low does this uncertainty impact bio-optical proper**

# NPP Ocean product validation
# Characterizing Satellite and insitu uncertainty
# - Northern Gulf – GeoCape

## nLw 551




8 %
*In situ*
uncertainty

15 %
satellite
uncertainty

VIIRS Rrs 551 (sr-1)

0.02
0.02
0.01
0.01
0
0

Satellite
Data pair

Insitu
Data
Pair

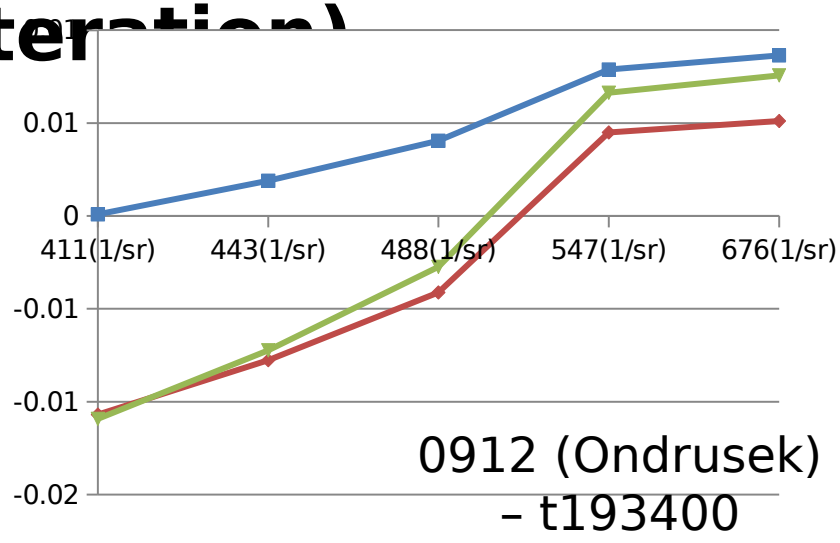
0
0.01
0.01
0.02
0.02

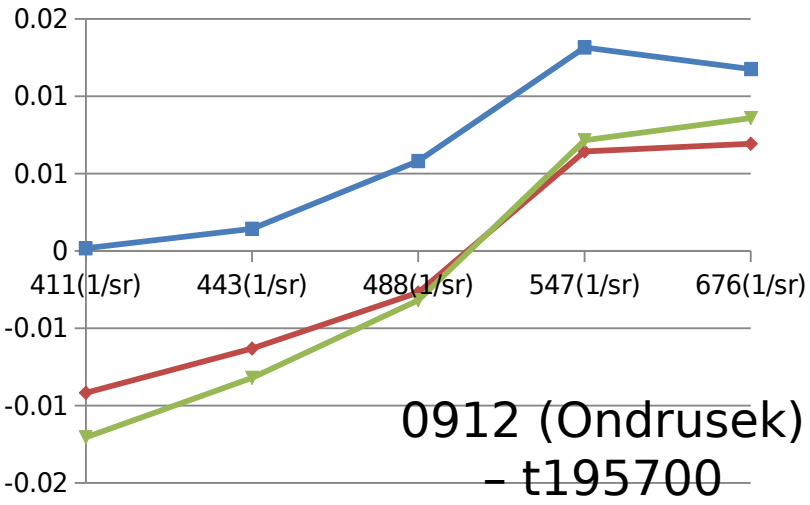
All_data 43
Simultaneous Points
Overlap
"

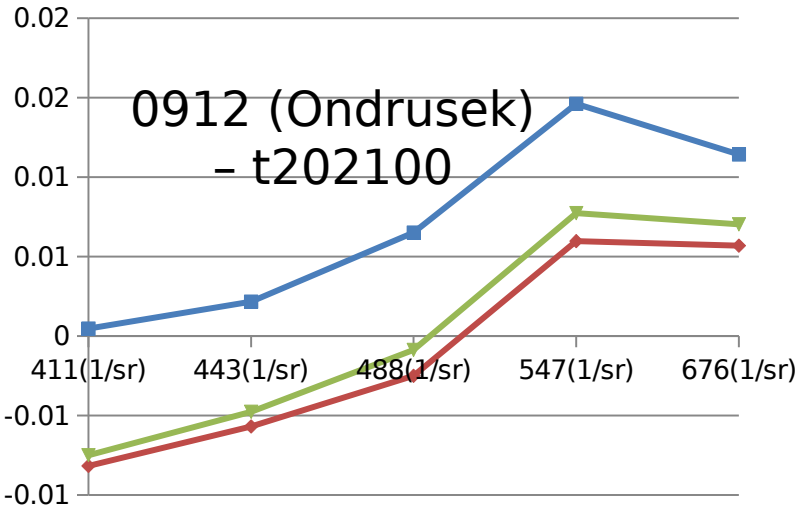
***In situ Rrs 551 (sr-1)***

Acknowledgements
M. Ondrusek / Z. Lee

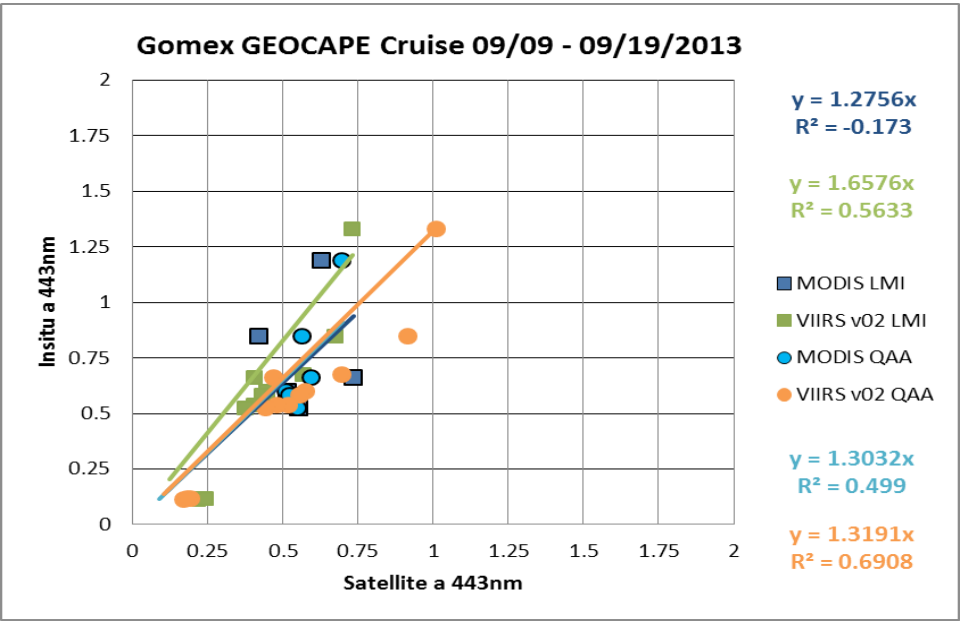
# NOAA IDPS – VOCCO Matchups (Negative in Blue Channels – NO NIR Coastal Iteration)

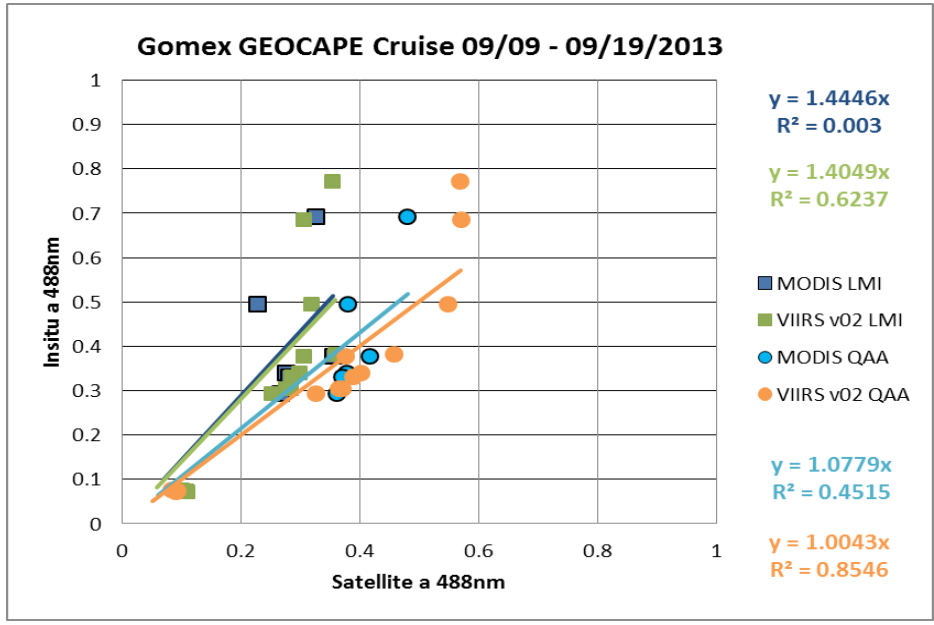


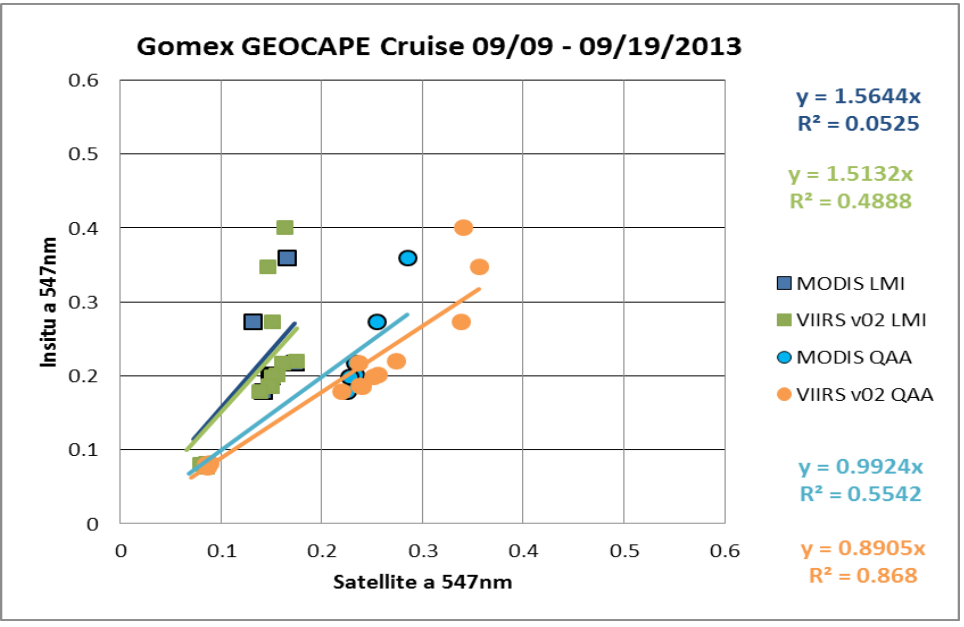



# OCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013 - Scatter



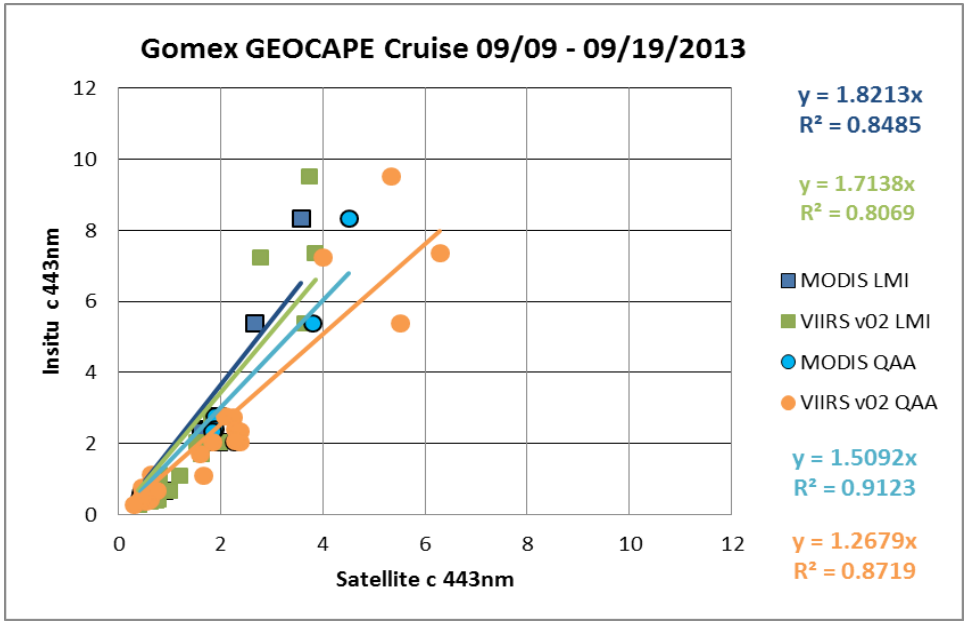



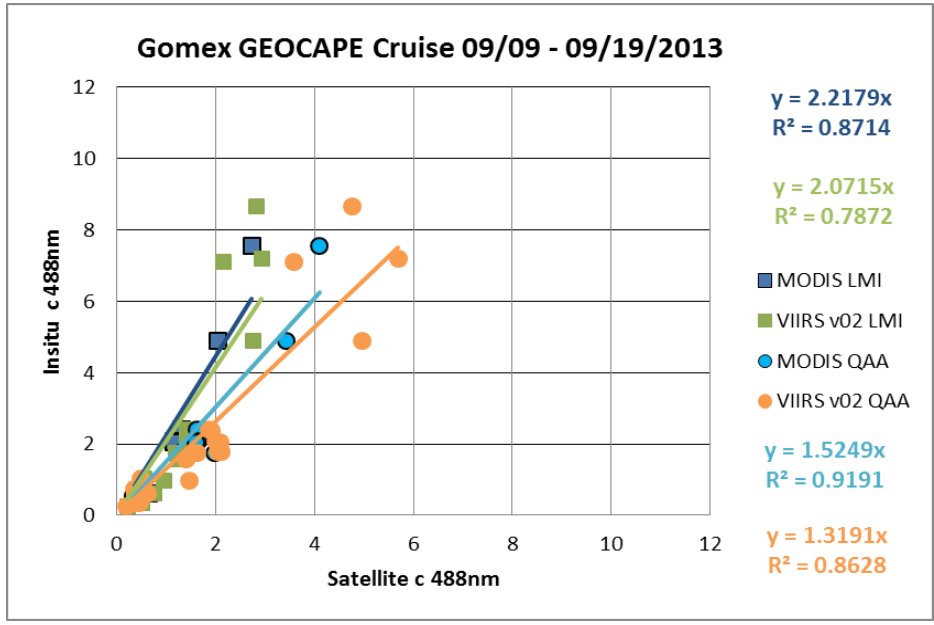



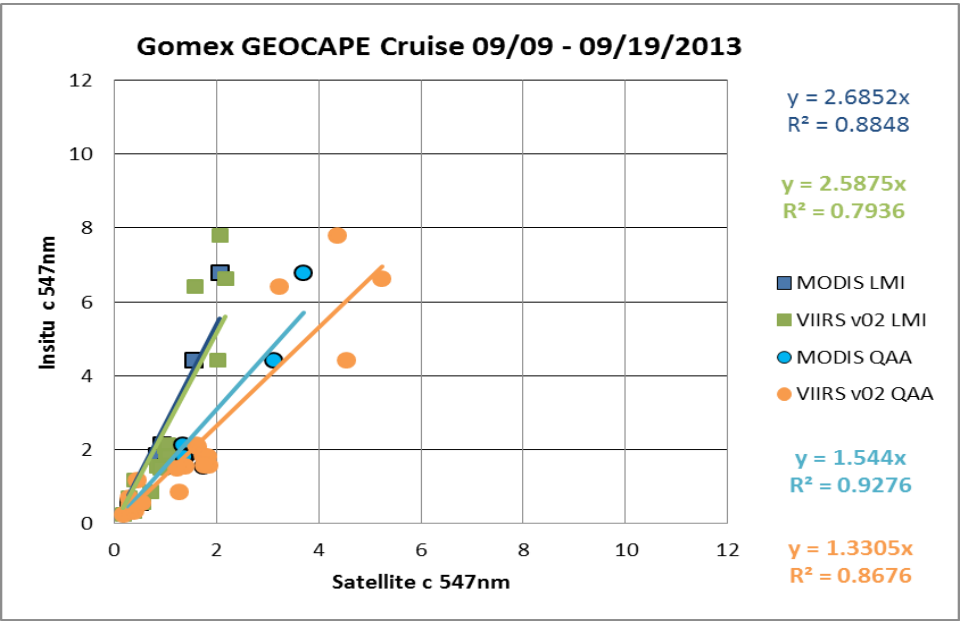

| SLOPE | a412 | a443 | a488 | a547 | c412 | c443 | c488 | c547 |
|---|---|---|---|---|---|---|---|---|
| ModLMI | 1.27 | 1.28 | 1.45 | 1.56 | 1.56 | 1.82 | 2.22 | 2.69 |
| ModQAA | 1.24 | 1.30 | 1.08 | 0.99 | 1.41 | 1.51 | 1.52 | 1.54 |
| VIIRS LMI | 1.42 | 1.66 | 1.40 | 1.51 | 1.33 | 1.71 | 2.07 | 2.59 |
| VIIRS QAA | 1.21 | 1.32 | 1.00 | 0.89 | 1.11 | 1.27 | 1.32 | 1.33 |
| | | | | | | | | |
| R2 | a412 | a443 | a488 | a547 | c412 | c443 | c488 | c547 |
| ModLMI | 0.01 | 0.02 | 0.05 | 0.06 | 0.91 | 0.92 | 0.94 | 0.95 |
| ModQAA | 0.20 | 0.78 | 0.75 | 0.99 | 0.92 | 0.93 | 0.93 | 0.93 |
| VIIRS LMI | 0.75 | 0.68 | 0.68 | 0.55 | 0.88 | 0.88 | 0.85 | 0.85 |
| VIIRS QAA | 0.79 | 0.73 | 0.87 | 0.87 | 0.86 | 0.88 | 0.87 | 0.87 |

**Insitu: UMASS/NOAA**

# OCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013 - Scatter



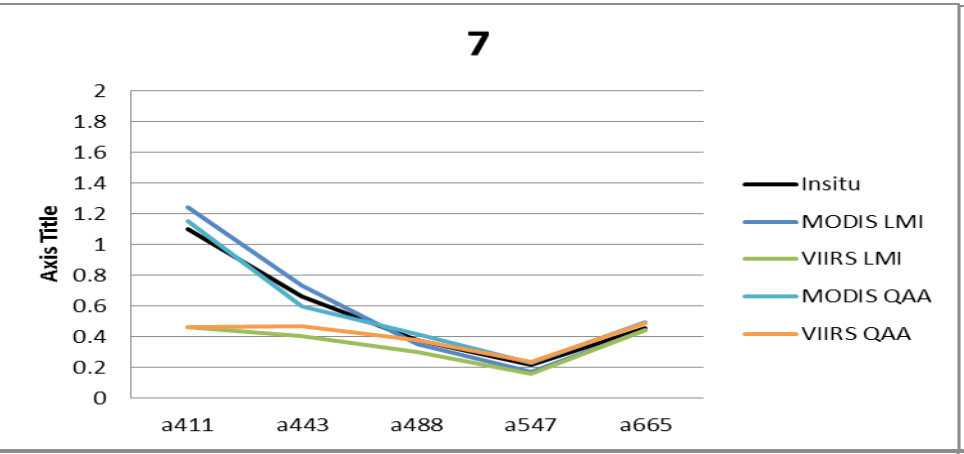



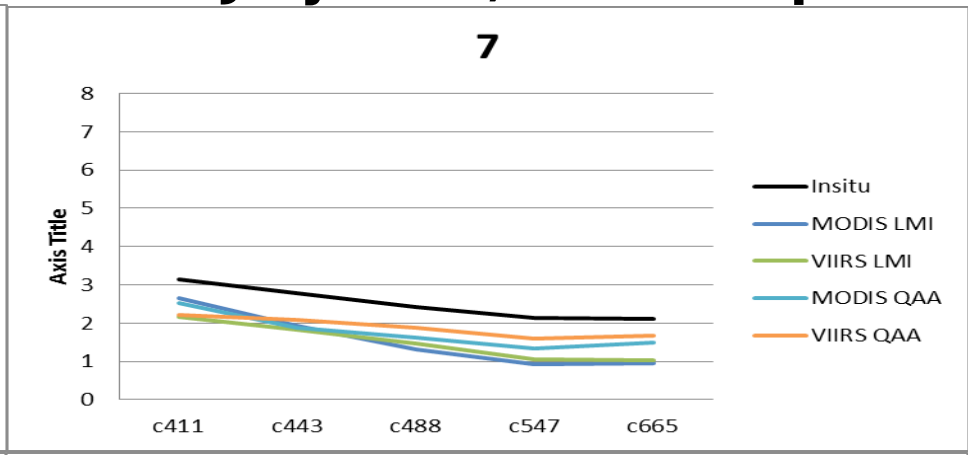



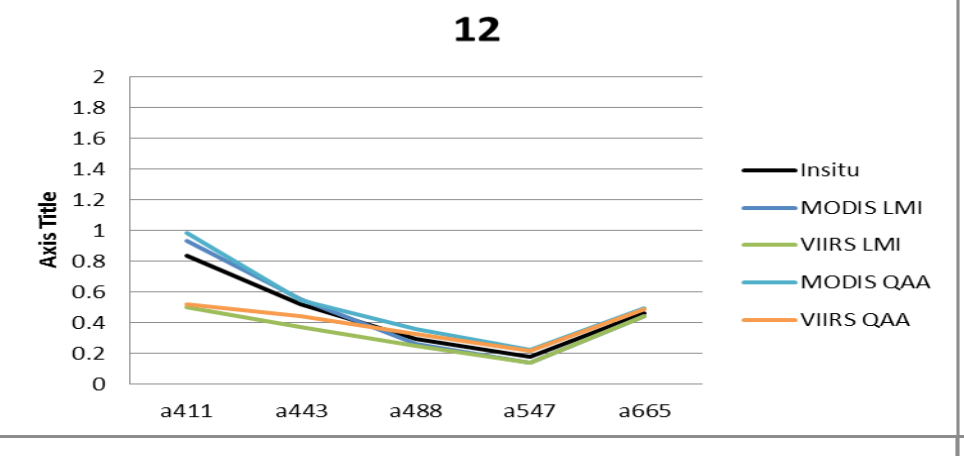

| SLOPE | a412 | a443 | a488 | a547 | c412 | c443 | c488 | c547 |
|---|---|---|---|---|---|---|---|---|
| ModLMI | 1.27 | 1.28 | 1.45 | 1.56 | 1.56 | 1.82 | 2.22 | 2.69 |
| ModQAA | 1.24 | 1.30 | 1.08 | 0.99 | 1.41 | 1.51 | 1.52 | 1.54 |
| VIIRS LMI | 1.42 | 1.66 | 1.40 | 1.51 | 1.33 | 1.71 | 2.07 | 2.59 |
| VIIRS QAA | 1.21 | 1.32 | 1.00 | 0.89 | 1.11 | 1.27 | 1.32 | 1.33 |
| | | | | | | | | |
| R2 | a412 | a443 | a488 | a547 | c412 | c443 | c488 | c547 |
| ModLMI | 0.01 | 0.02 | 0.05 | 0.06 | 0.91 | 0.92 | 0.94 | 0.95 |
| ModQAA | 0.20 | 0.78 | 0.75 | 0.99 | 0.92 | 0.93 | 0.93 | 0.93 |
| VIIRS LMI | 0.75 | 0.68 | 0.68 | 0.55 | 0.88 | 0.88 | 0.85 | 0.85 |
| VIIRS QAA | 0.79 | 0.73 | 0.87 | 0.87 | 0.86 | 0.88 | 0.87 | 0.87 |

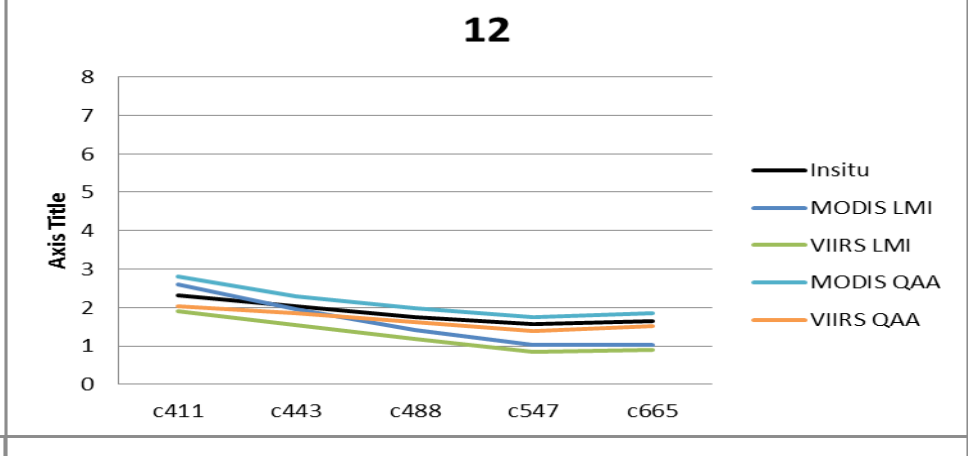
**Insitu: UMASS/NOAA**

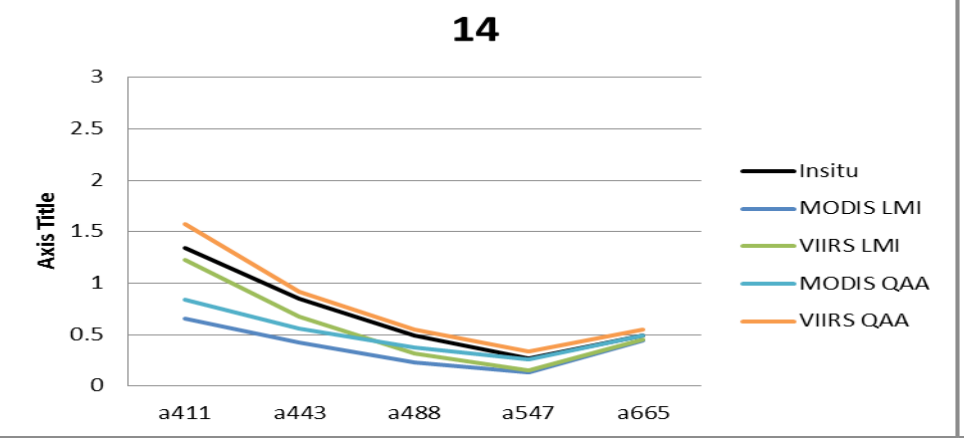
# OCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013 - Spectra

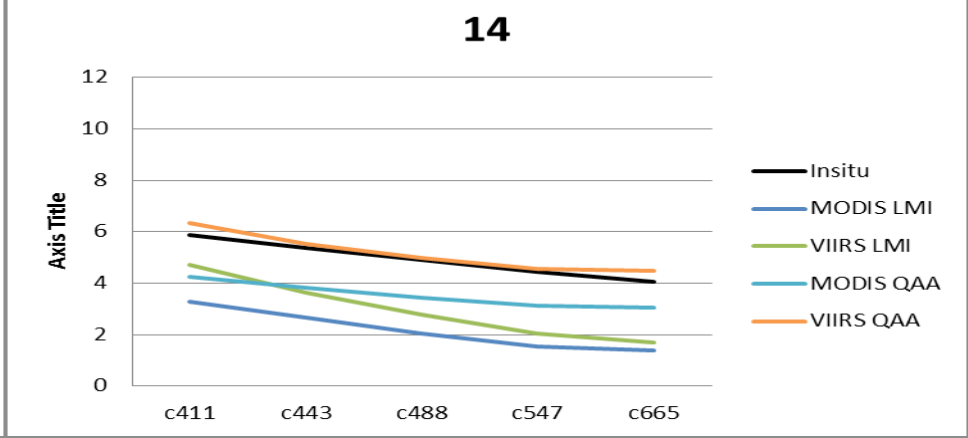


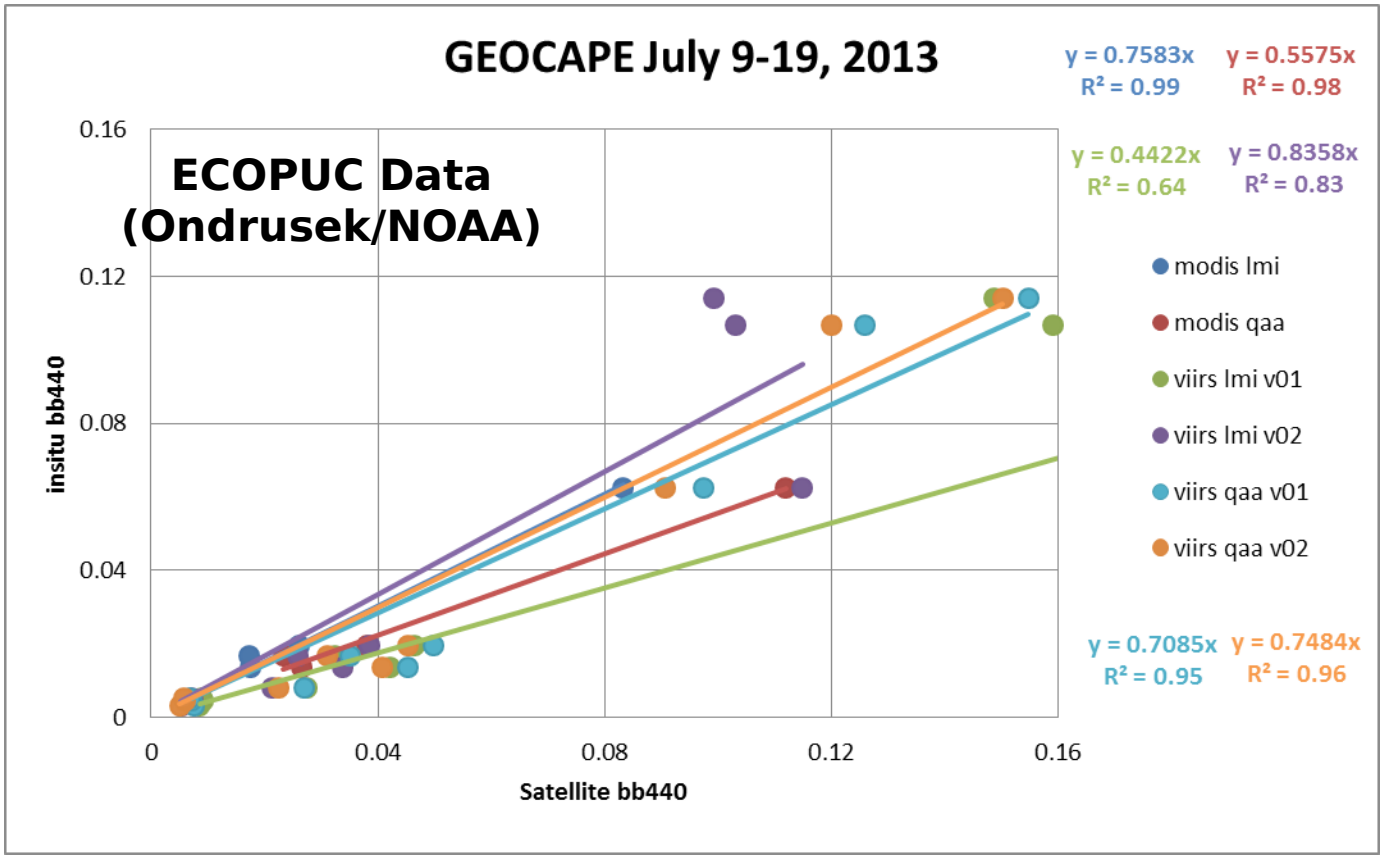



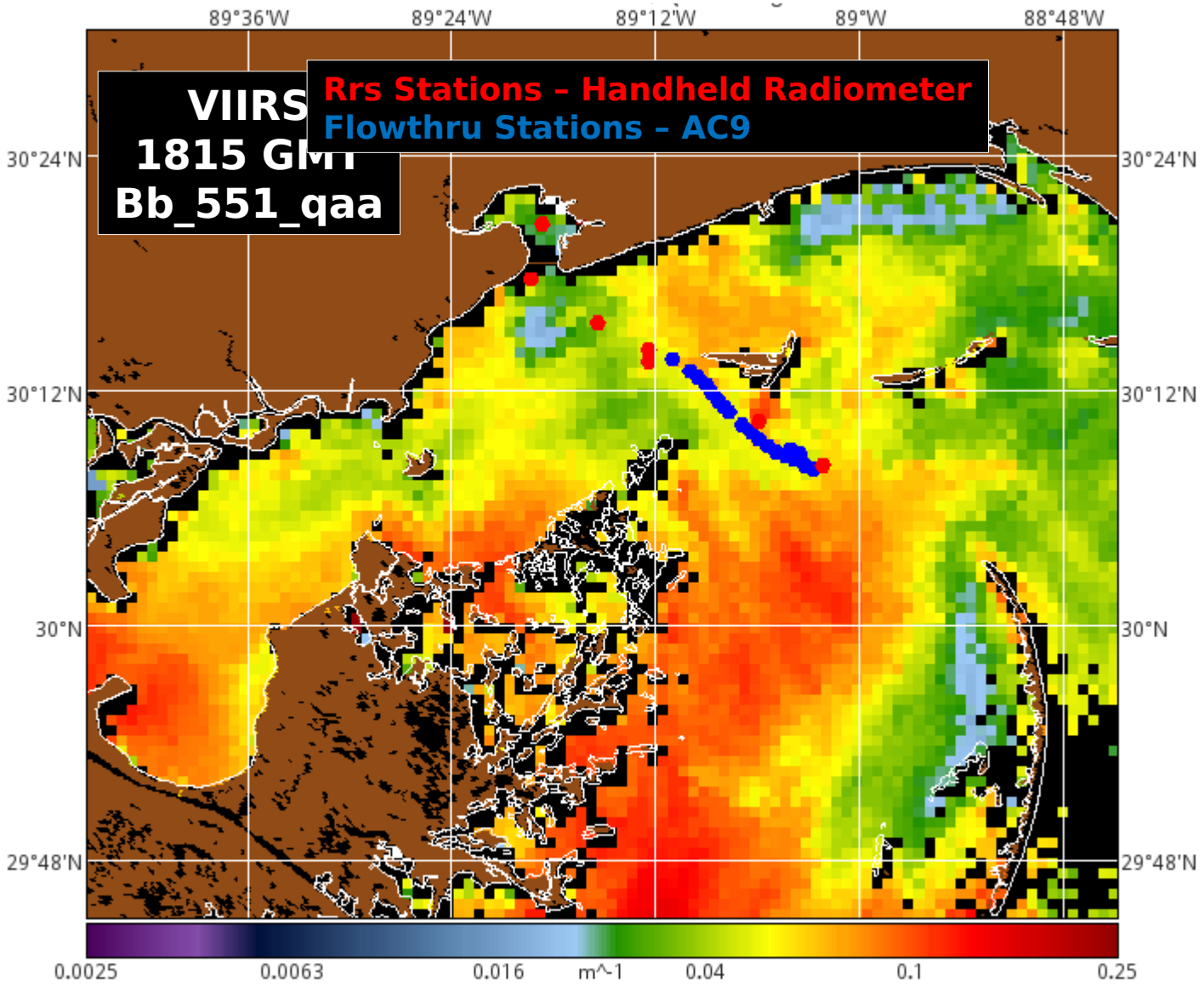



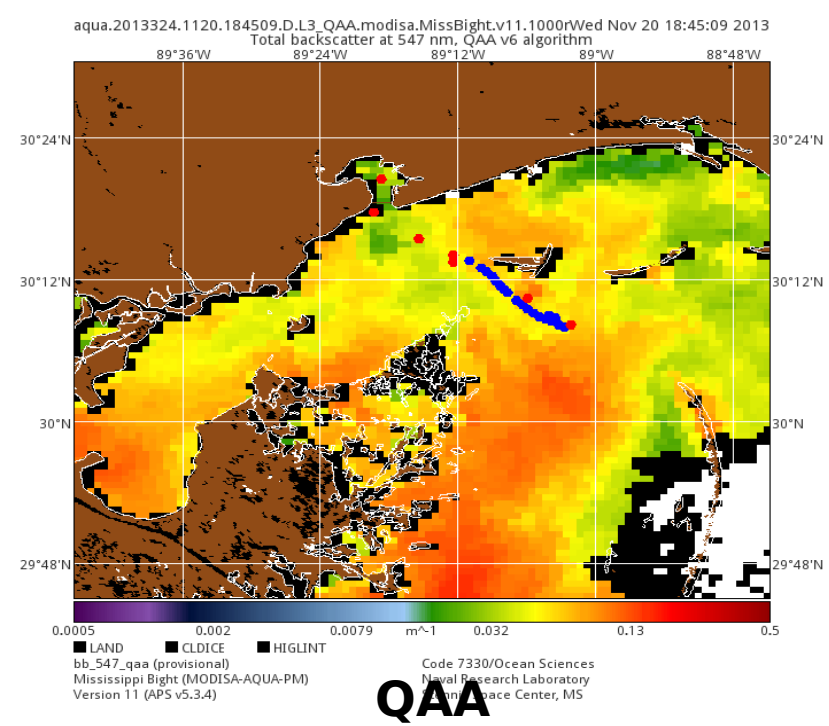
# GEOCAPE / Northern Gulf of Mexico Cruise July 9-19, 2013 - Scat



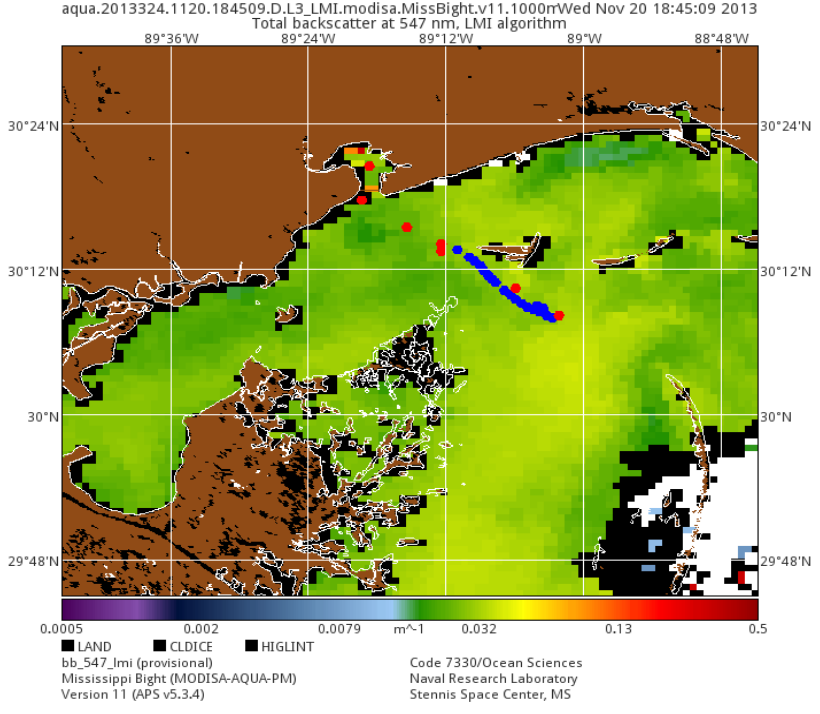

| bb440 | Rsquared | Slope |
|---|---|---|
| modis lmi | 0.9953 | 0.7600 |
| modis qaa | 0.9895 | 0.5600 |
| viirs lmi v01 | 0.6392 | 0.4400 |
| viirs lmi v02 | 0.8304 | 0.8400 |
| viirs qaa v01 | 0.9533 | 0.7100 |
| viirs qaa v02 | 0.9586 | 0.7500 |

# cean Color Cruise – November 20, 2013 – Mississippi S
# and IOP (Surface FlowThru +/- 30 Minutes from Satell

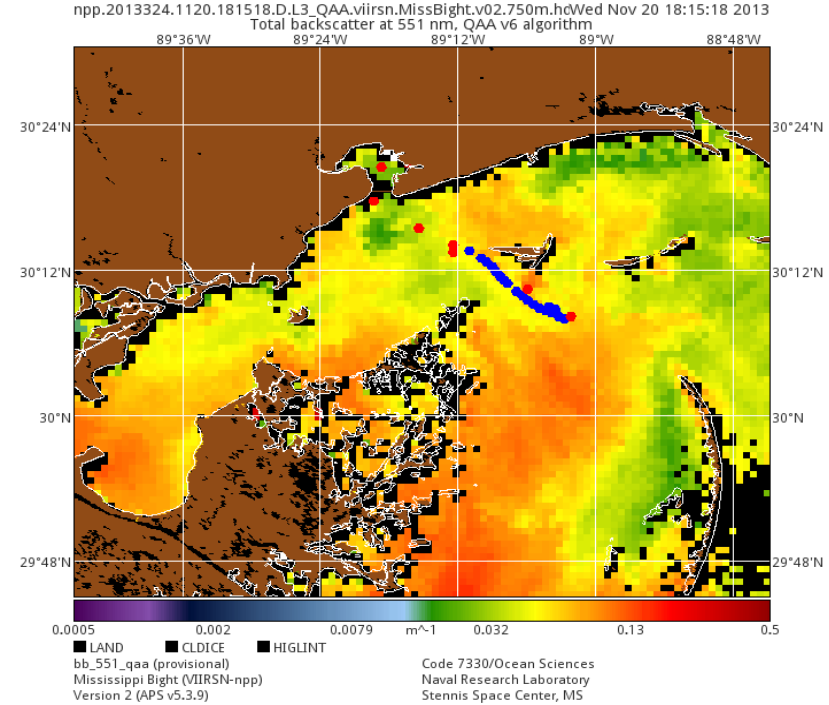




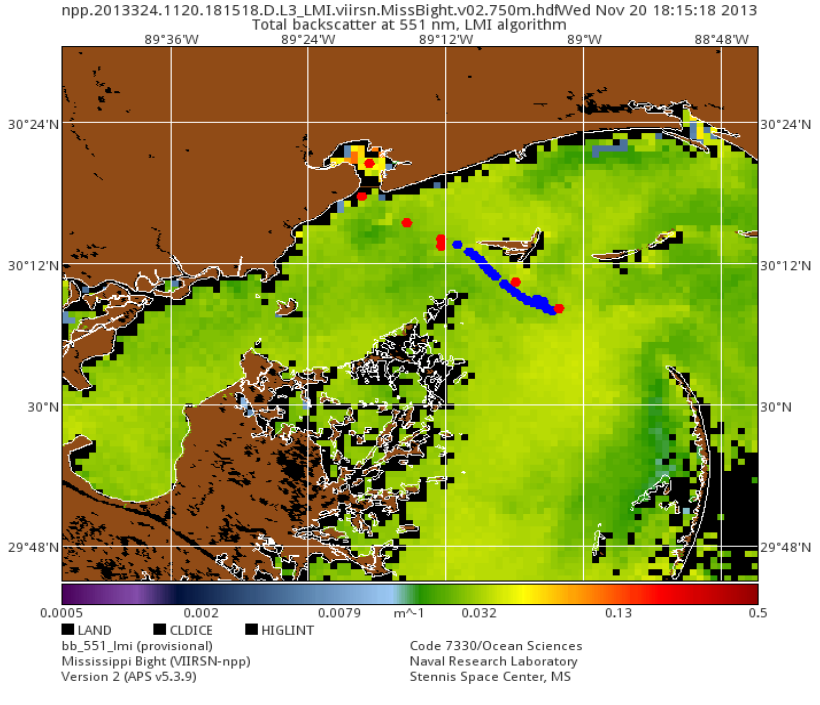

MODIS



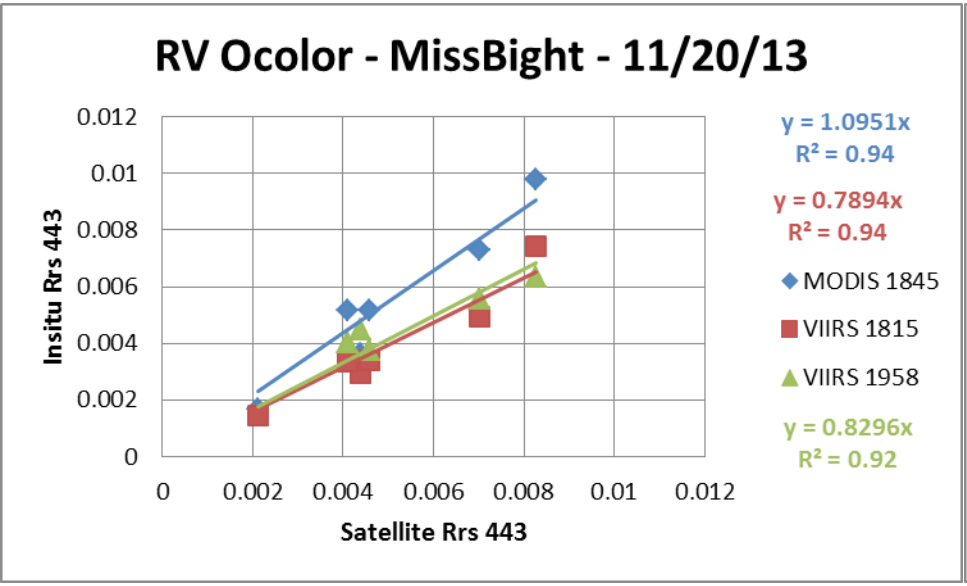

QAA

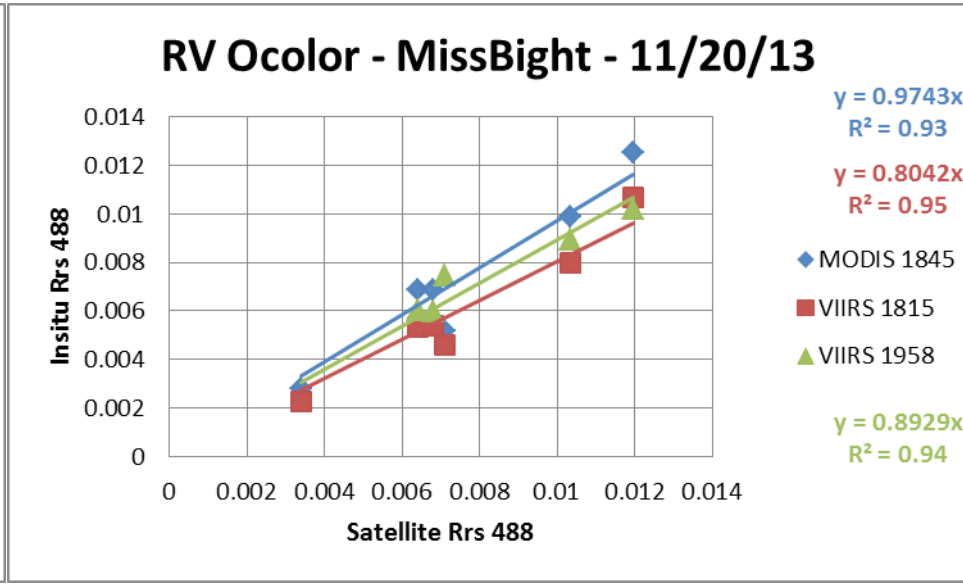


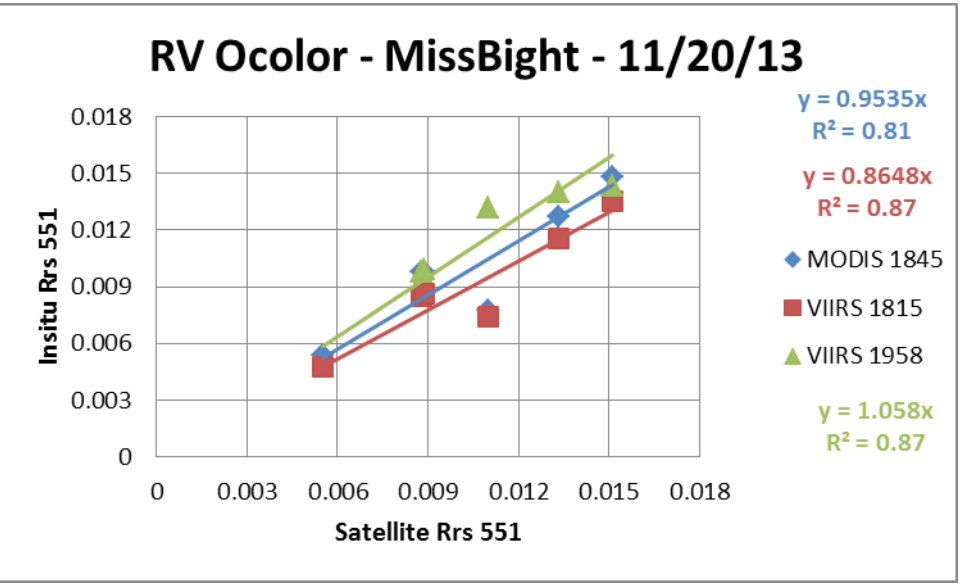

VIIRS



# Ocean Color Cruise Mississippi Sound November 20, 2013 - Sca



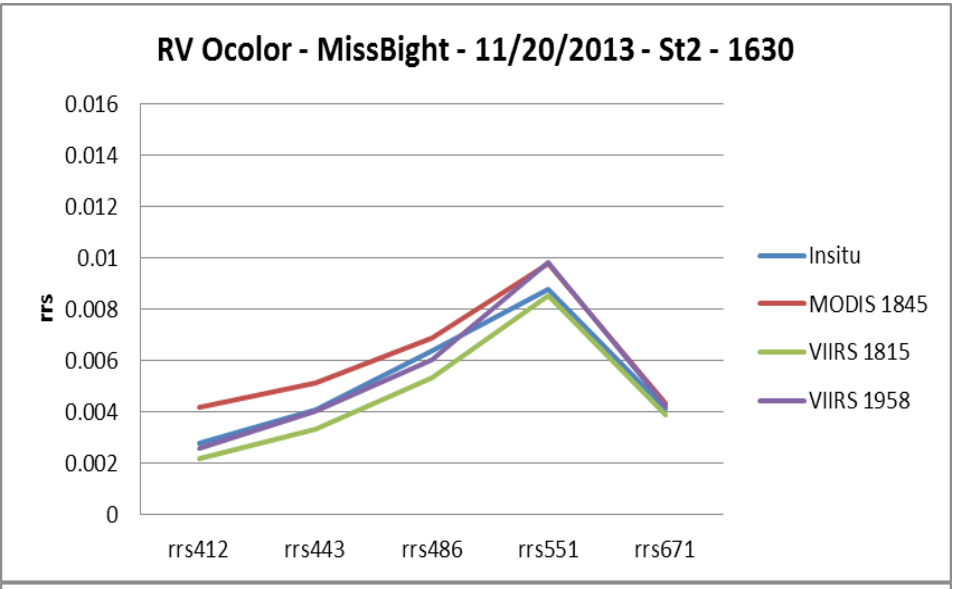



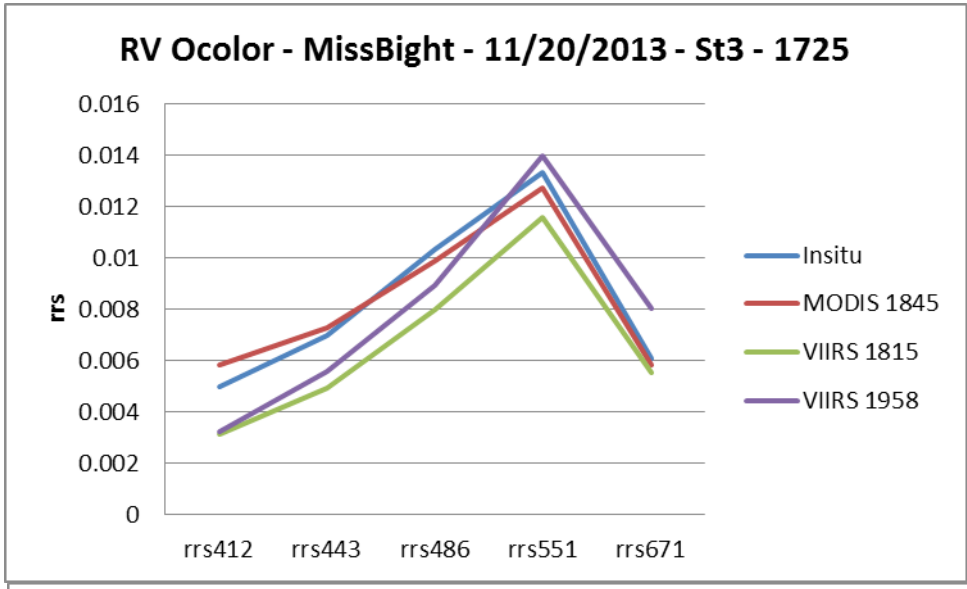



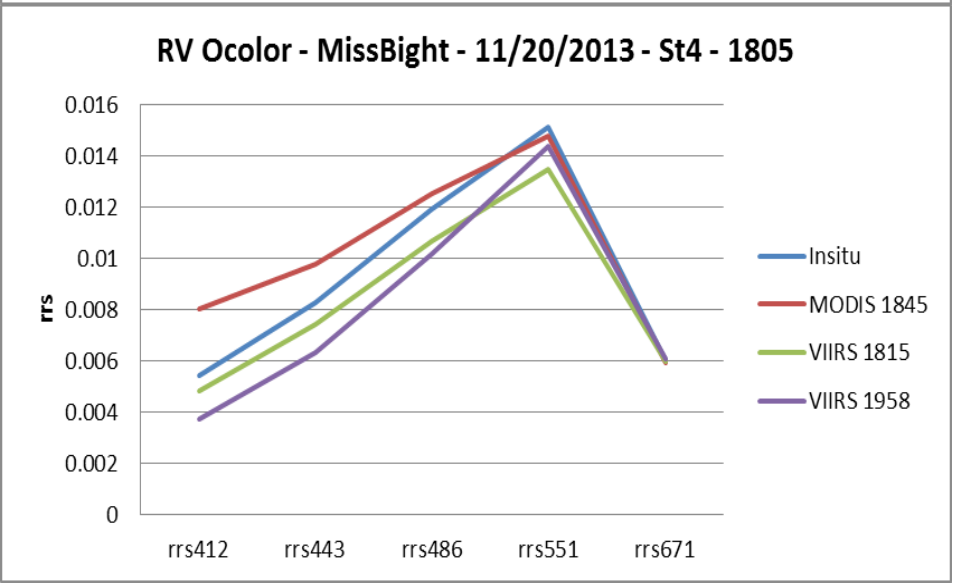

| Slope | rrs412 | rrs443 | rrs488 | rrs547 |
|---|---|---|---|---|
| MODIS 1845 | 1.31 | 1.09 | 0.97 | 0.95 |
| VIIRS 1815 | 0.76 | 0.79 | 0.80 | 0.86 |
| VIIRS 1957 | 0.77 | 0.83 | 0.89 | 1.06 |

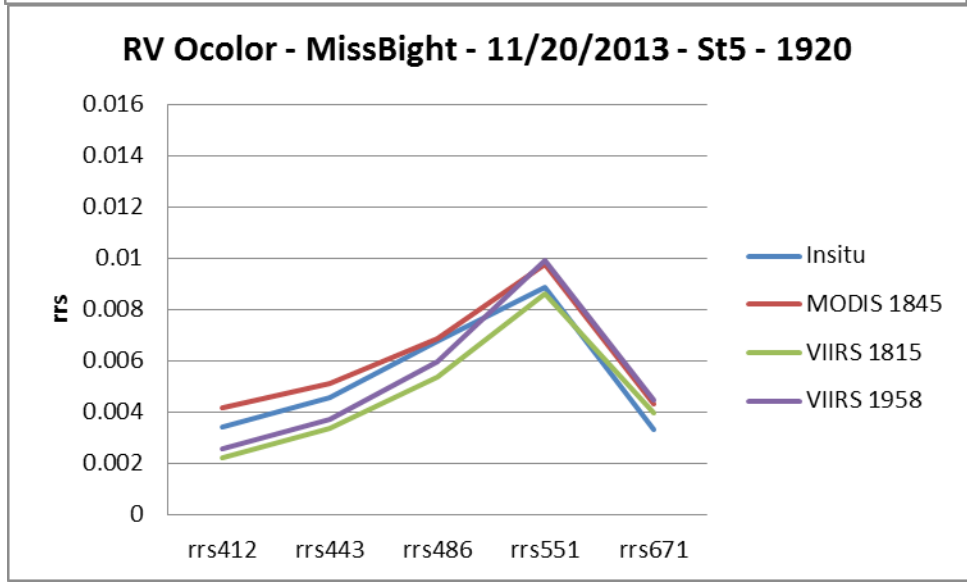
| Rsquared | rrs412 | rrs443 | rrs488 | rrs547 |
|---|---|---|---|---|
| MODIS 1845 | 0.93 | 0.94 | 0.93 | 0.81 |
| VIIRS 1815 | 0.85 | 0.94 | 0.95 | 0.87 |
| VIIRS 1957 | 0.28 | 0.92 | 0.94 | 0.87 |

# Ocean Color Cruise Mississippi Sound November 20, 2013 - Spe



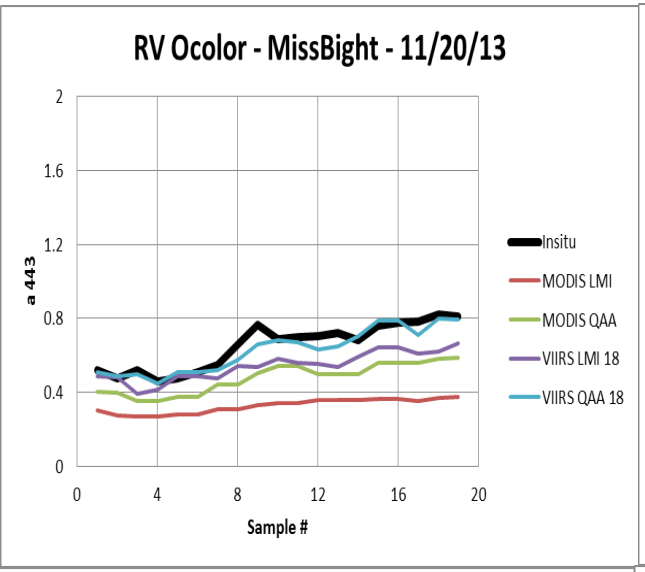



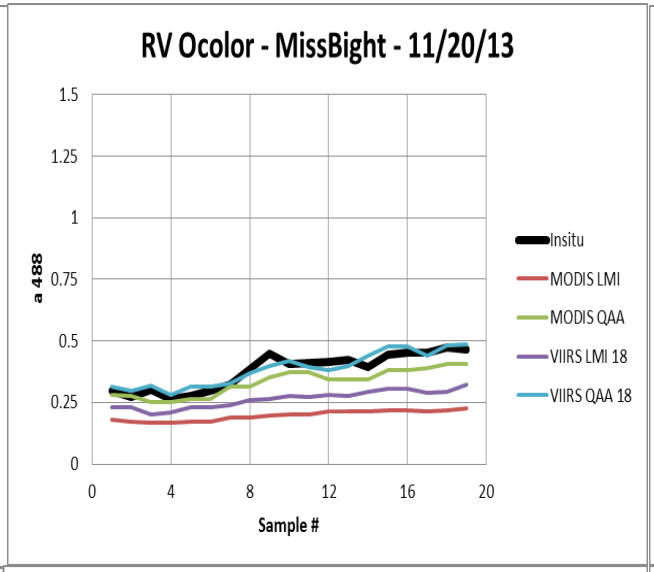



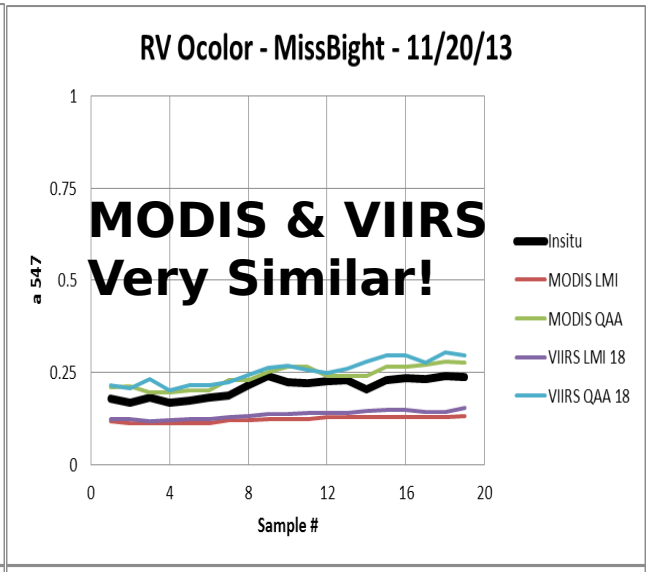



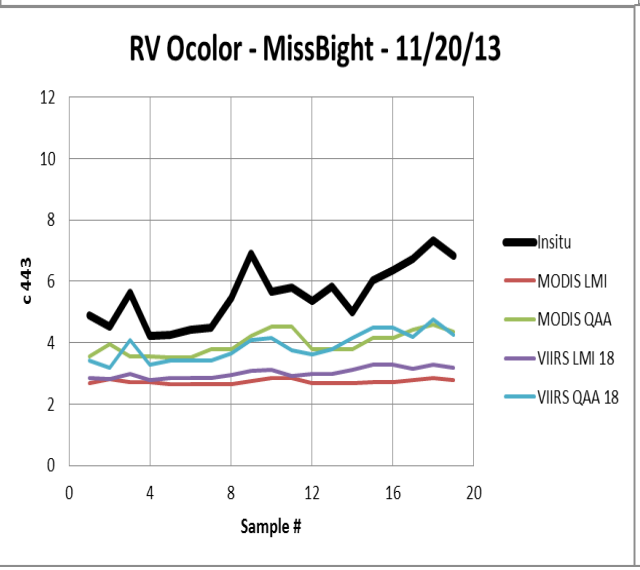
# R/V Ocean Color Cruise Mississippi Sound November 20, 2013

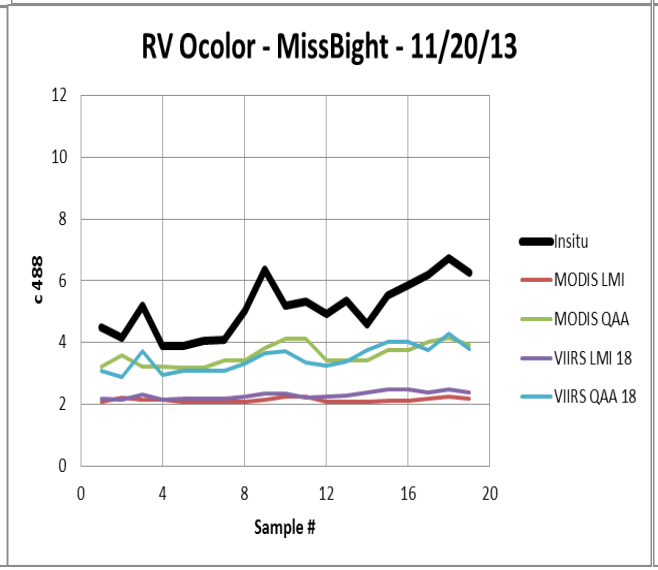
## FlowThru (+/- 30 minutes of early/late satellite pass)

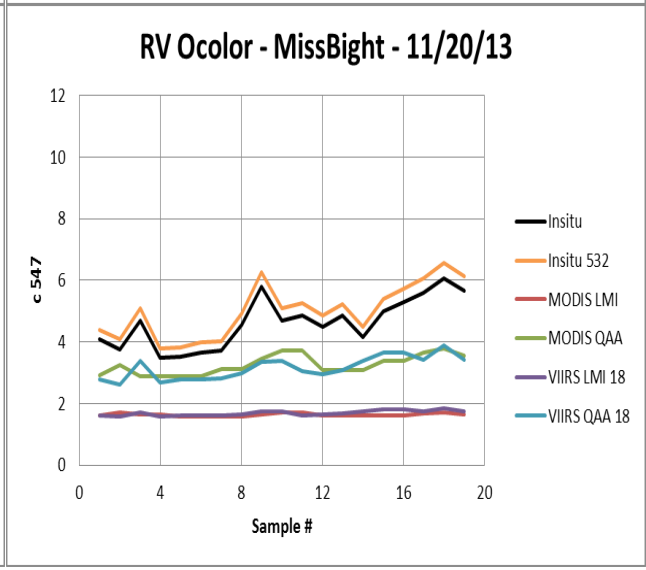


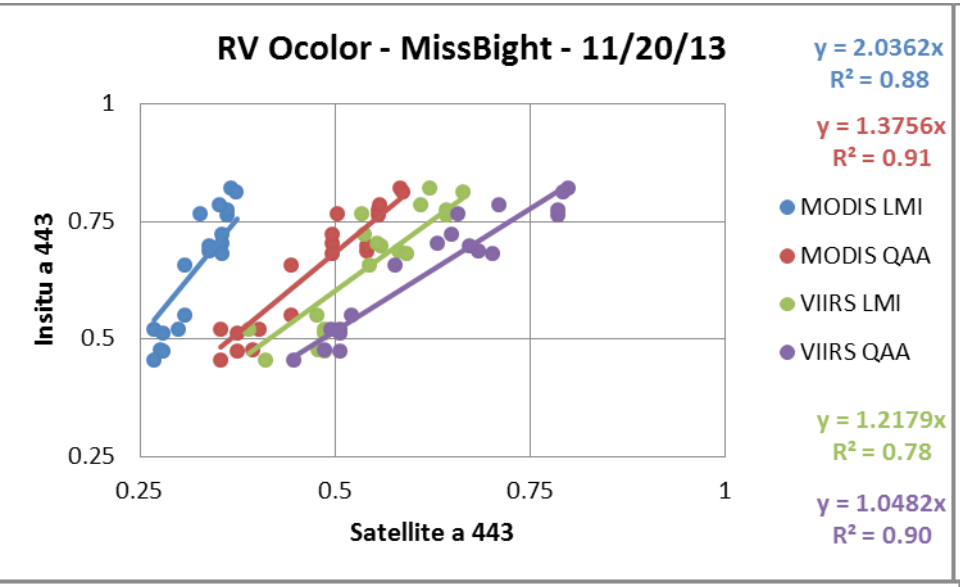



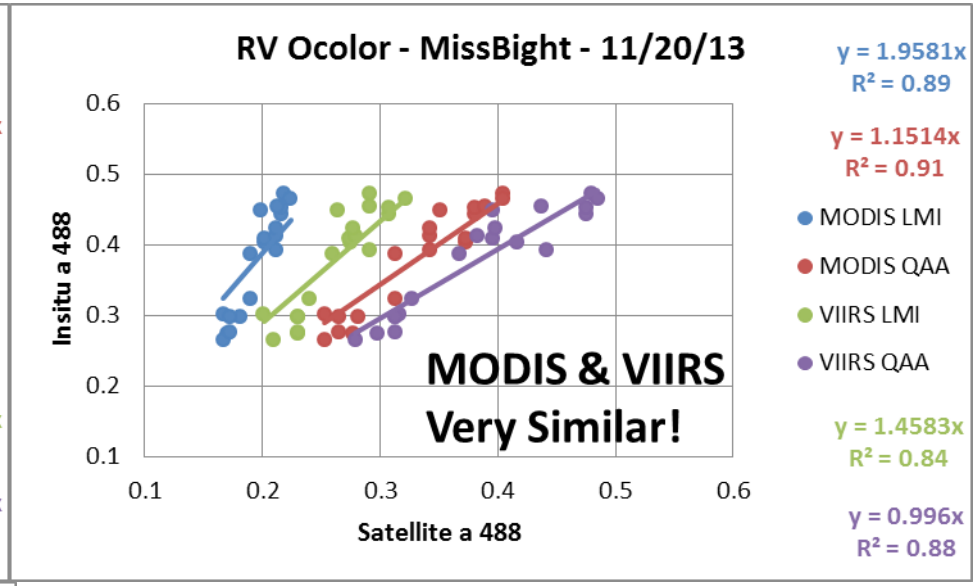



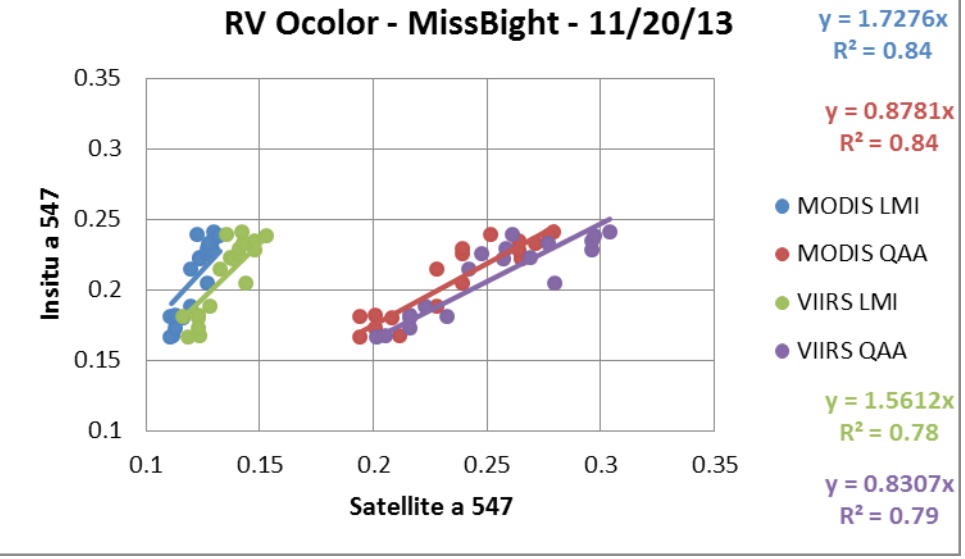

**Satellite bb/b** **Insitu profile bb/b**

# R/V Ocean Color Cruise Mississippi Sound November 20, 2013

## FlowThru (+/- 30 minutes of early/late satellite pass)



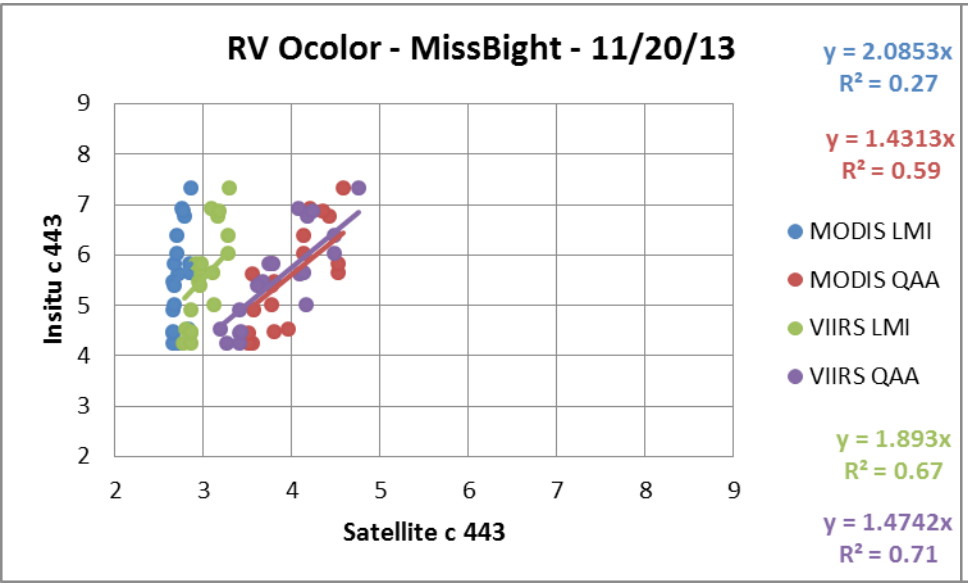



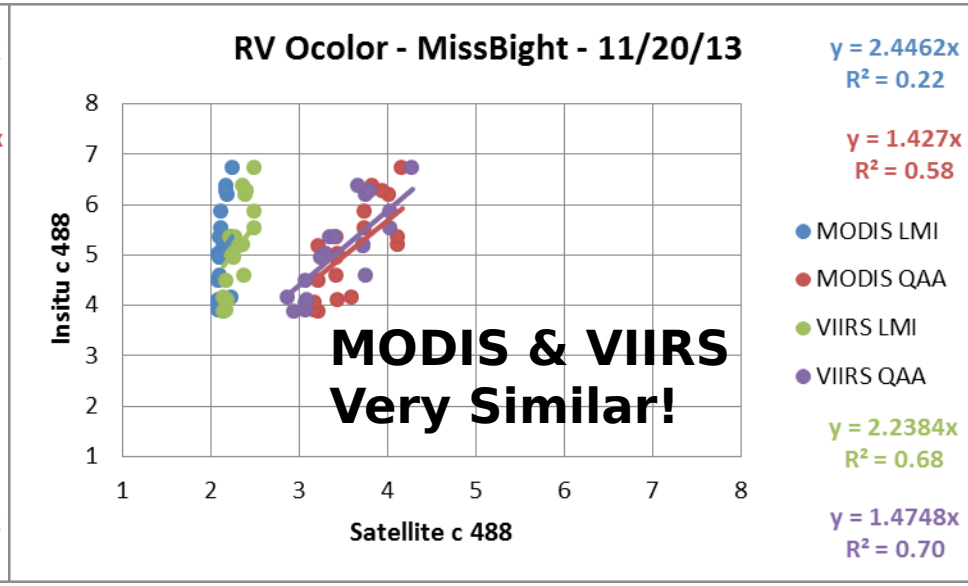

| SLOPE | a412 | a443 | a488 | a547 |
|---|---|---|---|---|
| ModLMI | 1.95 | 2.03 | 1.96 | 1.73 |
| ModQAA | 1.48 | 1.38 | 1.15 | 0.88 |
| VIIRSLMI | 0.93 | 1.22 | 1.46 | 1.56 |
| VIIRSQAA | 0.85 | 1.05 | 0.99 | 0.83 |

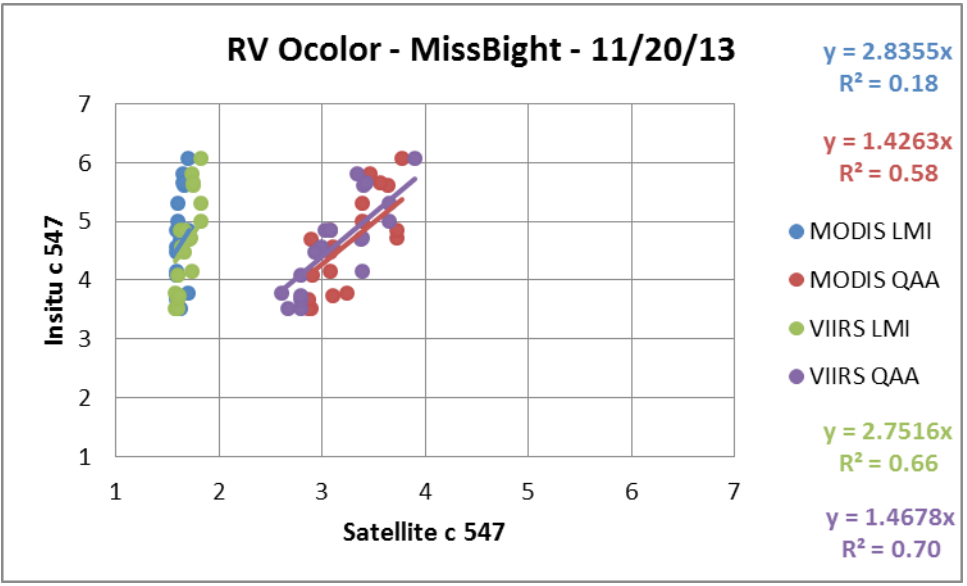
| R2 | a412 | a443 | a488 | a547 |
|---|---|---|---|---|
| ModLMI | 0.86 | 0.88 | 0.89 | 0.84 |
| ModQAA | 0.90 | 0.91 | 0.91 | 0.84 |
| VIIRSLMI | 0.72 | 0.78 | 0.84 | 0.78 |
| VIIRSQAA | 0.80 | 0.90 | 0.88 | 0.79 |

# R/V Ocean Color Cruise Mississippi Sound November 20, 2013

## FlowThru (+/- 30 minutes of early/late satellite pass)




| SLOPE | c412 | c443 | c488 | c547 |
|---|---|---|---|---|
| ModLMI | 1.84 | 2.09 | 2.45 | 2.84 |
| ModQAA | 1.41 | 1.43 | 1.43 | 1.43 |
| VIIRSLMI | 1.56 | 1.89 | 2.24 | 2.75 |
| VIIRSQAA | 1.37 | 1.47 | 1.48 | 1.47 |

| R2 | c412 | c443 | c488 | c547 |
|---|---|---|---|---|
| ModLMI | 0.31 | 0.27 | 0.22 | 0.18 |
| ModQAA | 0.59 | 0.59 | 0.58 | 0.58 |
| VIIRSLMI | 0.67 | 0.69 | 0.68 | 0.66 |
| VIIRSQAA | 0.71 | 0.72 | 0.70 | 0.70 |

# Evaluation of GOCI, MODIS, and VIIRS Imagery
# Objective

- Evaluate current NRL processing of GOCI level 1b water leaving radiance ($nL_w$)
- Provide an inter-sensor comparison between GOCI, MODIS, and VIIRS remote sensing reflectances
- Compare GOCI, MODIS, and VIIRS with East China Sea Aeronet Ocean Color (Gageocho and Ieodo) data

**2014 AGU OCEAN SCIENCES (Crout, et.al.)**

# Evaluation of GOCI, MODIS, and VIIRS Imagery
# Background - Data

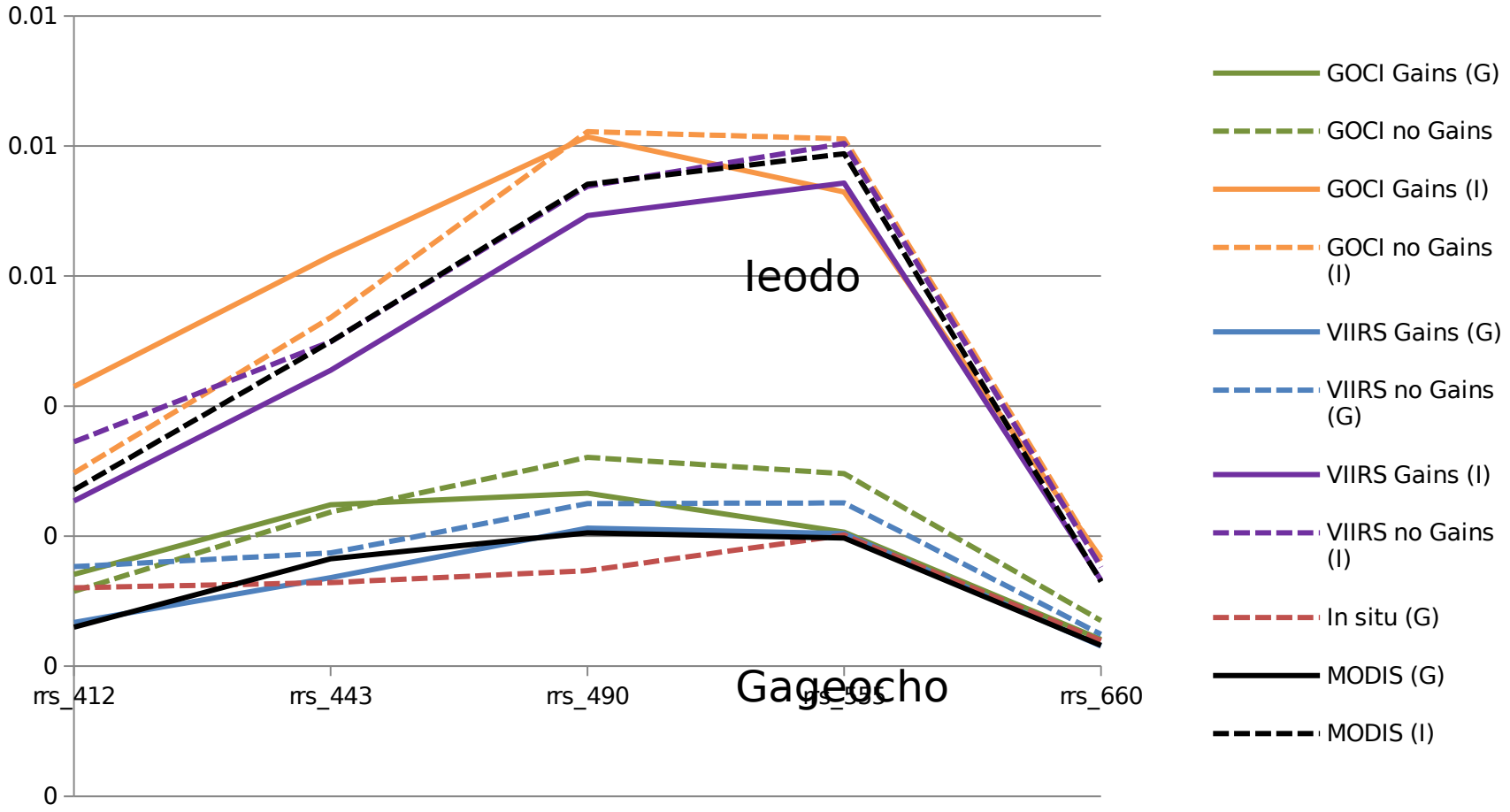
- MODIS
  - Processed with MOBY gains
- VIIRS
  - Processed with MOBY gains
- GOCI
  - Processed with MODIS-SWIR-derived vicarious calibration gains
  - GOCI data from 4Z GTM (corresponds to local 1 pm)
    - Reduces sun glint and sensor issues
- Aeronet SeaPrism
  - Gageocho Aeronet (SeaPrism #624) was moved to Ieodo
    - Results in a data gap from May 2012 – December 2013
    - The quality control of the data is near real time?

# Evaluation of GOCI, MODIS, and VIIRS Imagery
# Background - Processing

- Operational Ocean Color Processing
  - NRL's Automated Processing System (APS) based on n2gen software (NRL/NASA R&D)
  - Level 1b data obtained from NOAA CLASS (MODIS) and NAVO (GOCI and MODIS)
  - Atmospheric correction using Gordon-Wang NIR with 80 aerosol models
  - Glint and cloud removal

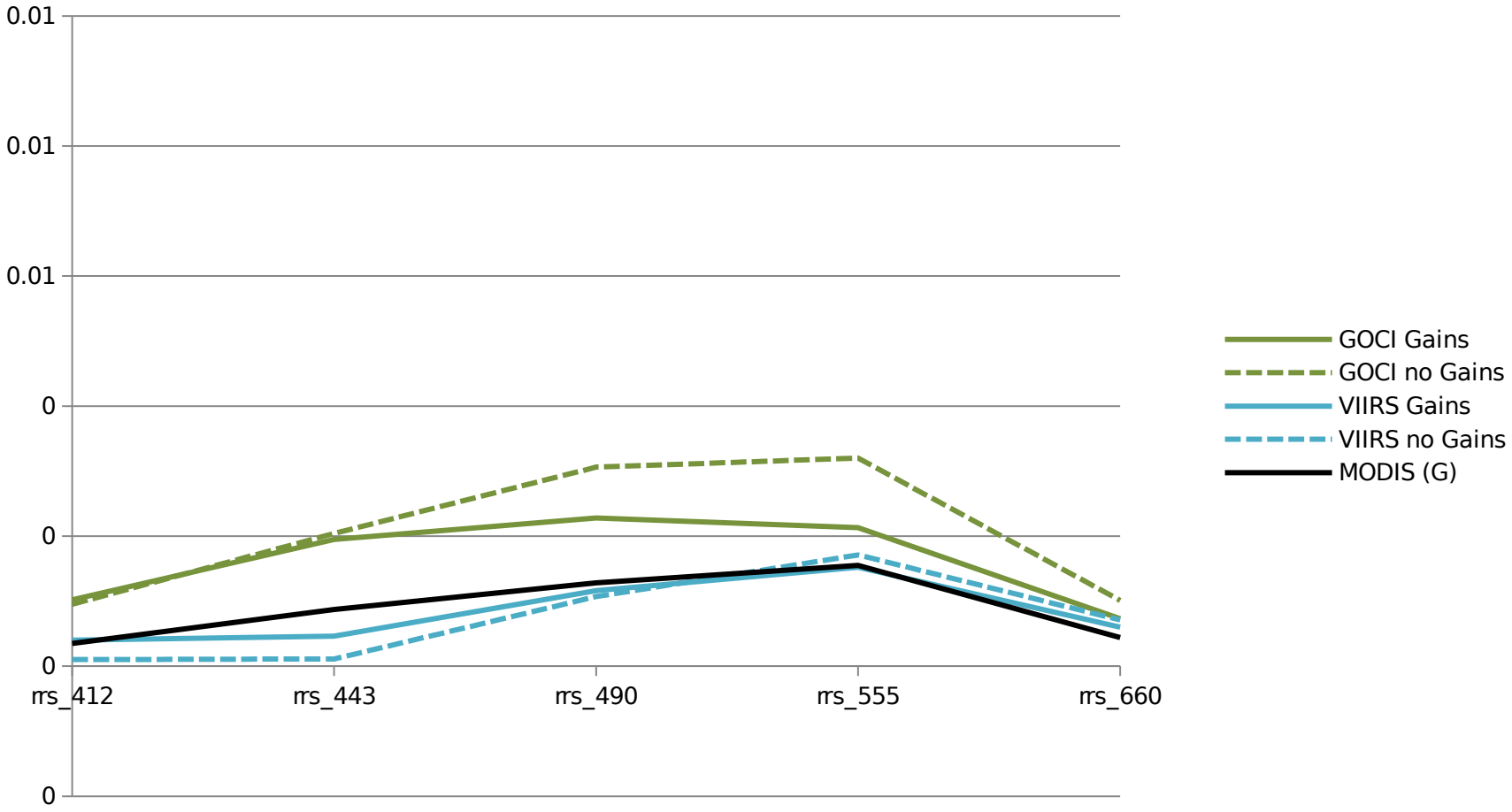
# Evaluation of GOCI, MODIS, and VIIRS Imagery

# JD 118 2012 Spectra – Gageocho and Ieodo



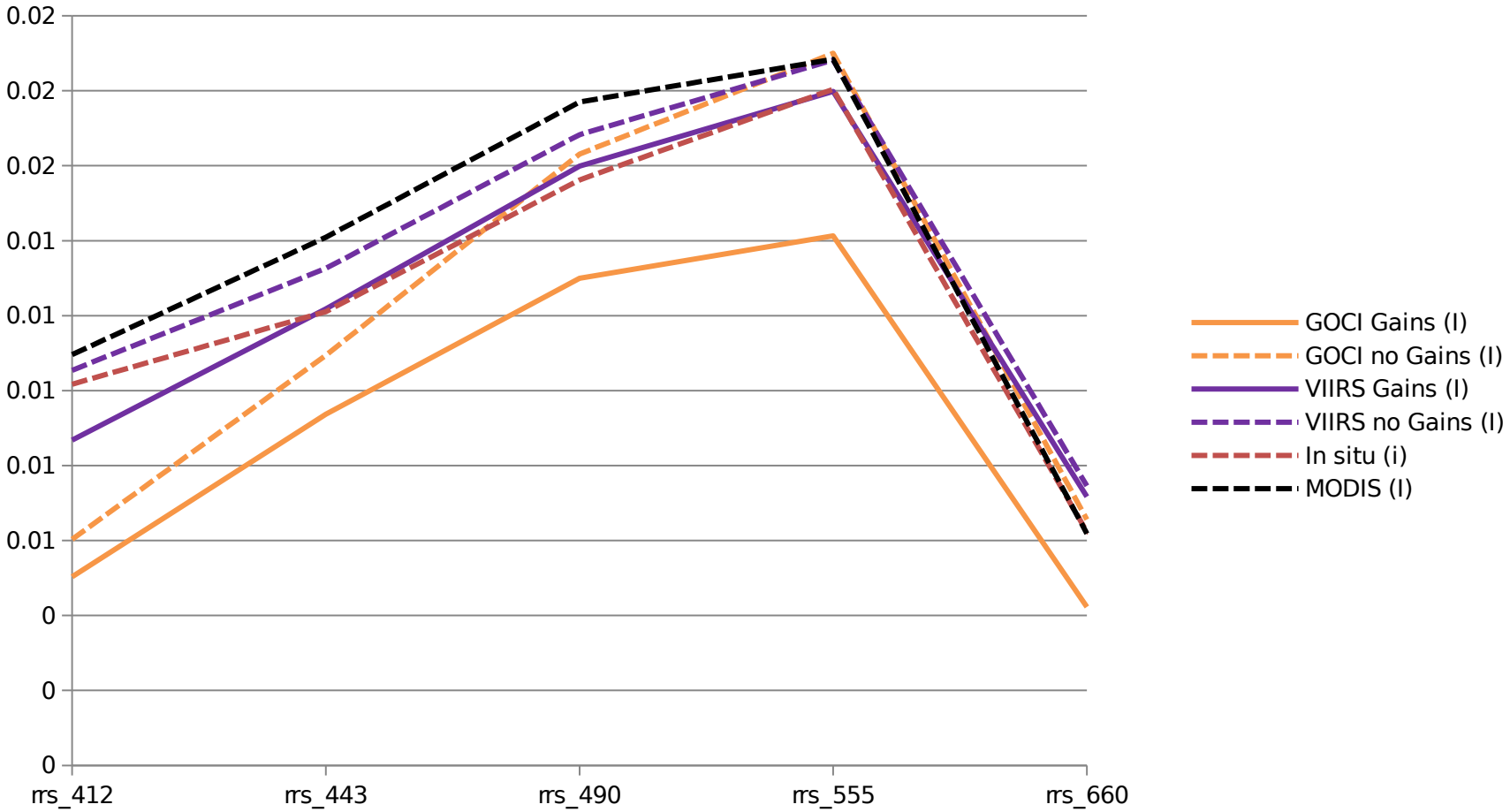
# Evaluation of GOCI, MODIS, and VIIRS Imagery

# JD 277 2013 Spectra – Gageocho



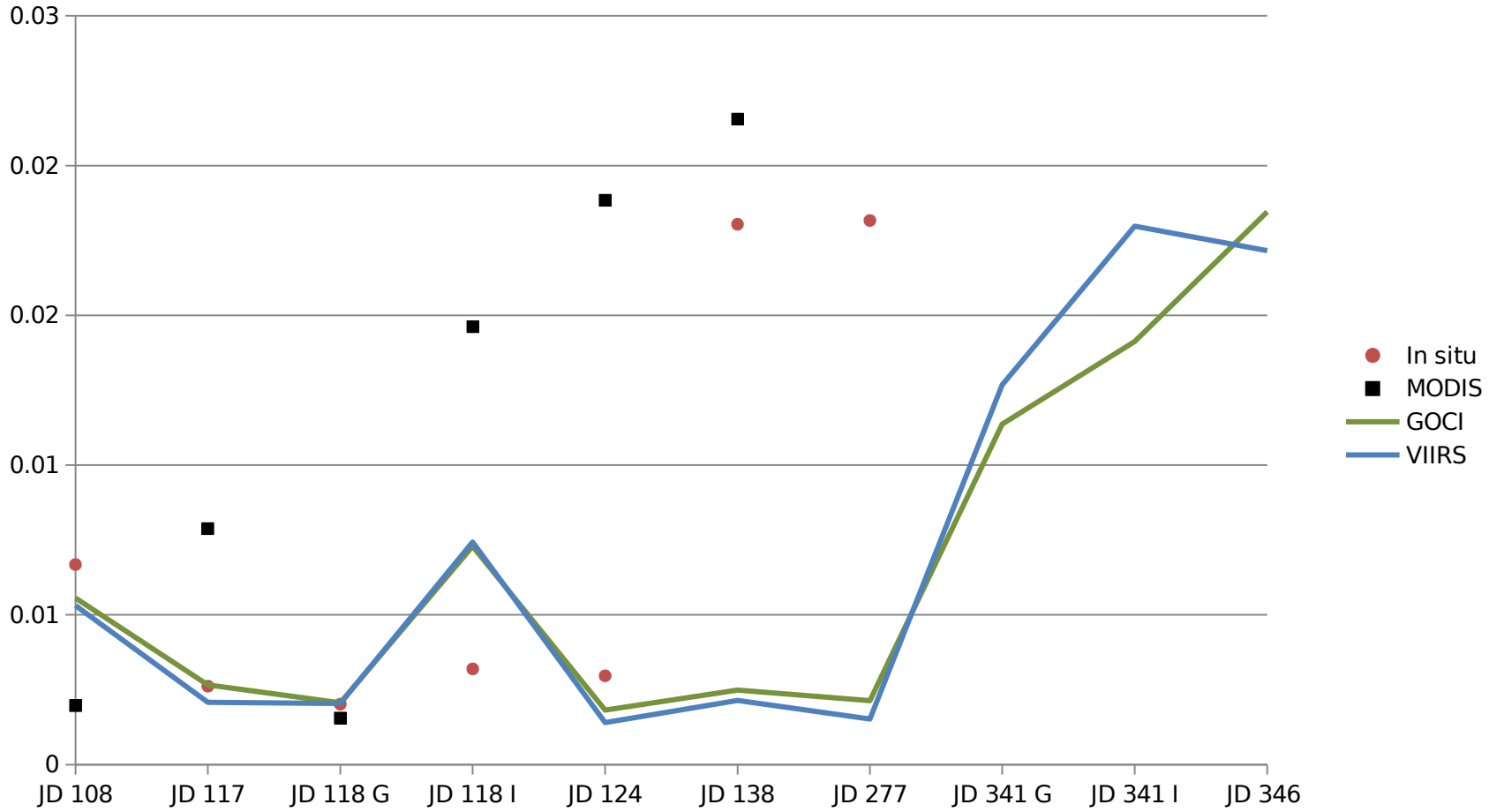
# Evaluation of GOCI, MODIS, and VIIRS Imagery

# JD 341 2013 spectra – leodo



# Evaluation of GOCI, MODIS, and VIIRS Imagery

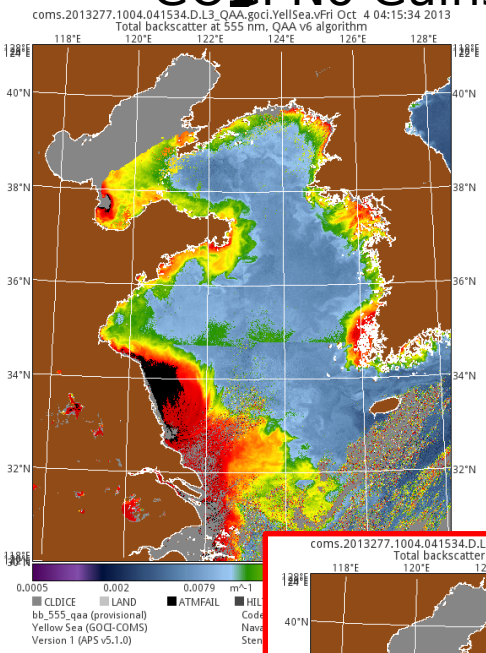
# All sensors (4Z) time series - rrs 550



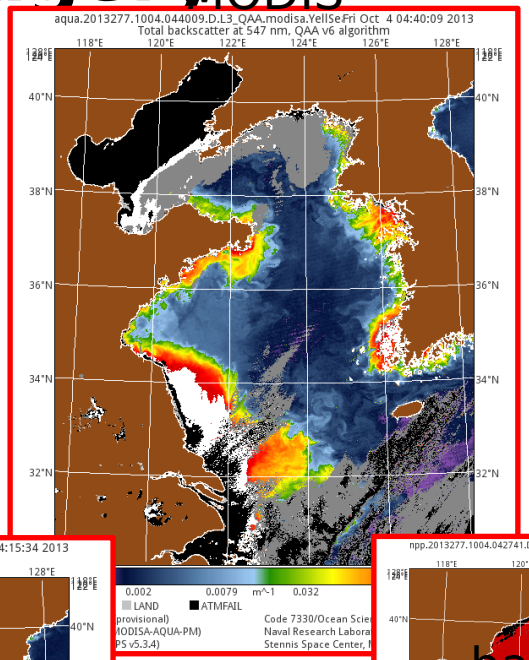
# Evaluation of GOCI, MODIS, and VIIRS Imagery - bb 551nm

## JD 277 Imagery

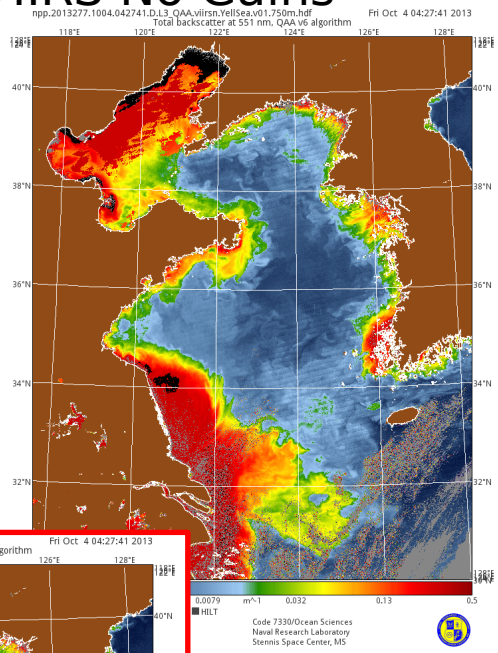
GOCI No Gains



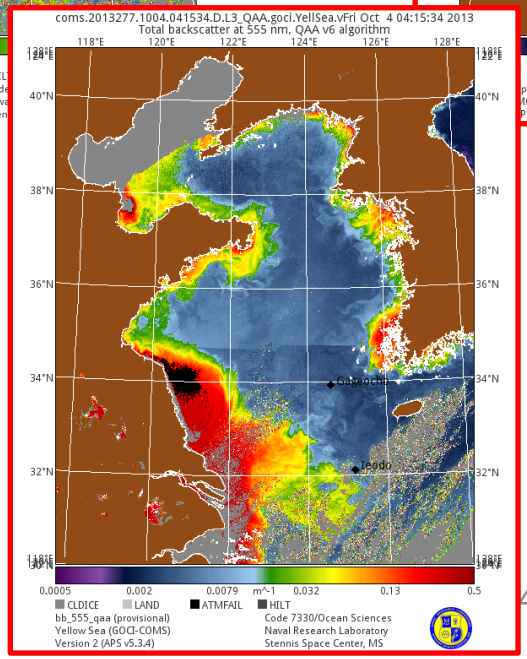

MODIS



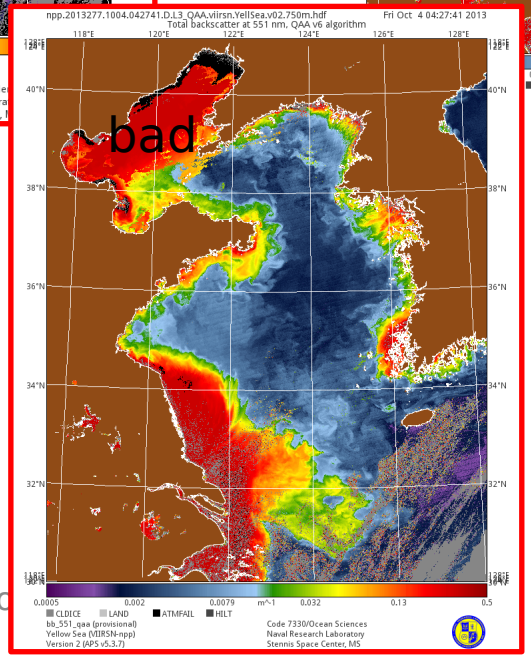

VIIRS No Gains




GOCI Gains

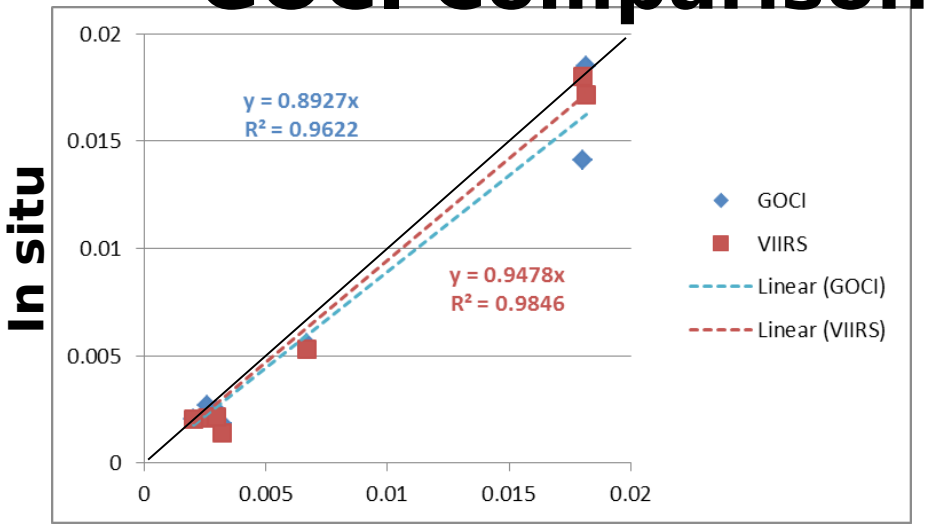



VIIRS Gains

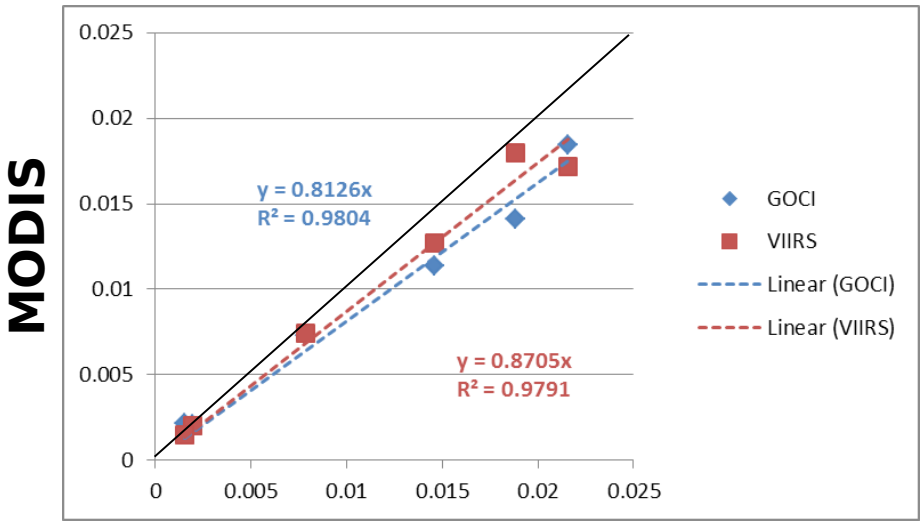


# Evaluation of GOCI, MODIS, and VIIRS Imagery

## rrs 555: MODIS, in situ, VIIRS, and GOCI Comparison




GOCI - VIIRS



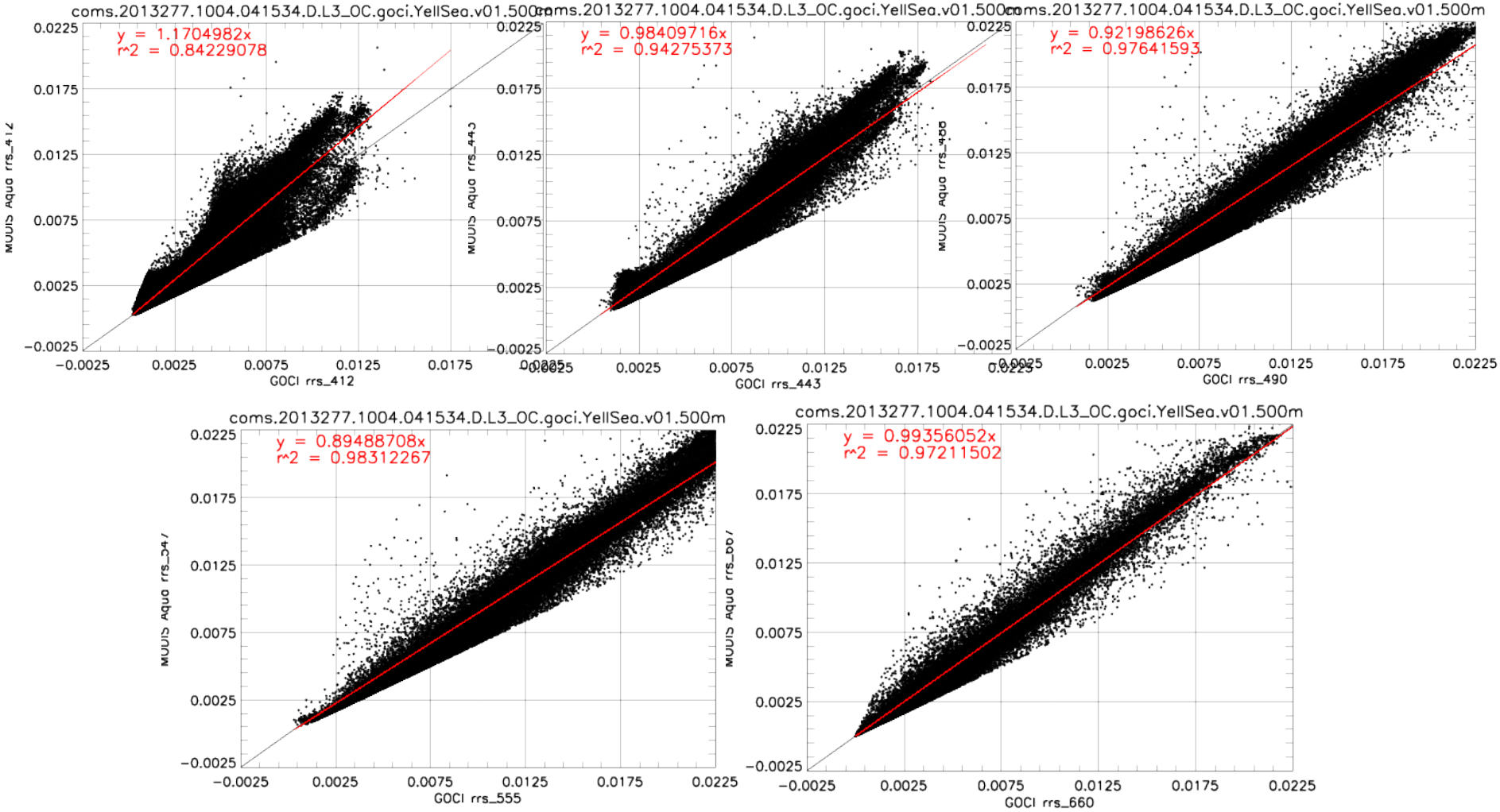

GOCI - VIIRS

| rrs 555 | Slope | $R^2$ |
|---|---|---|
| GOCI In situ | 0.893 | 0.962 |
| GOCI MODIS | 0.813 | 0.980 |
| VIIRS In situ | 0.948 | 0.985 |
| VIIRS MODIS | 0.871 | 0.979 |

Seems MODIS Is a lower in coast NASA coming Out with new Calibration in Mid March.

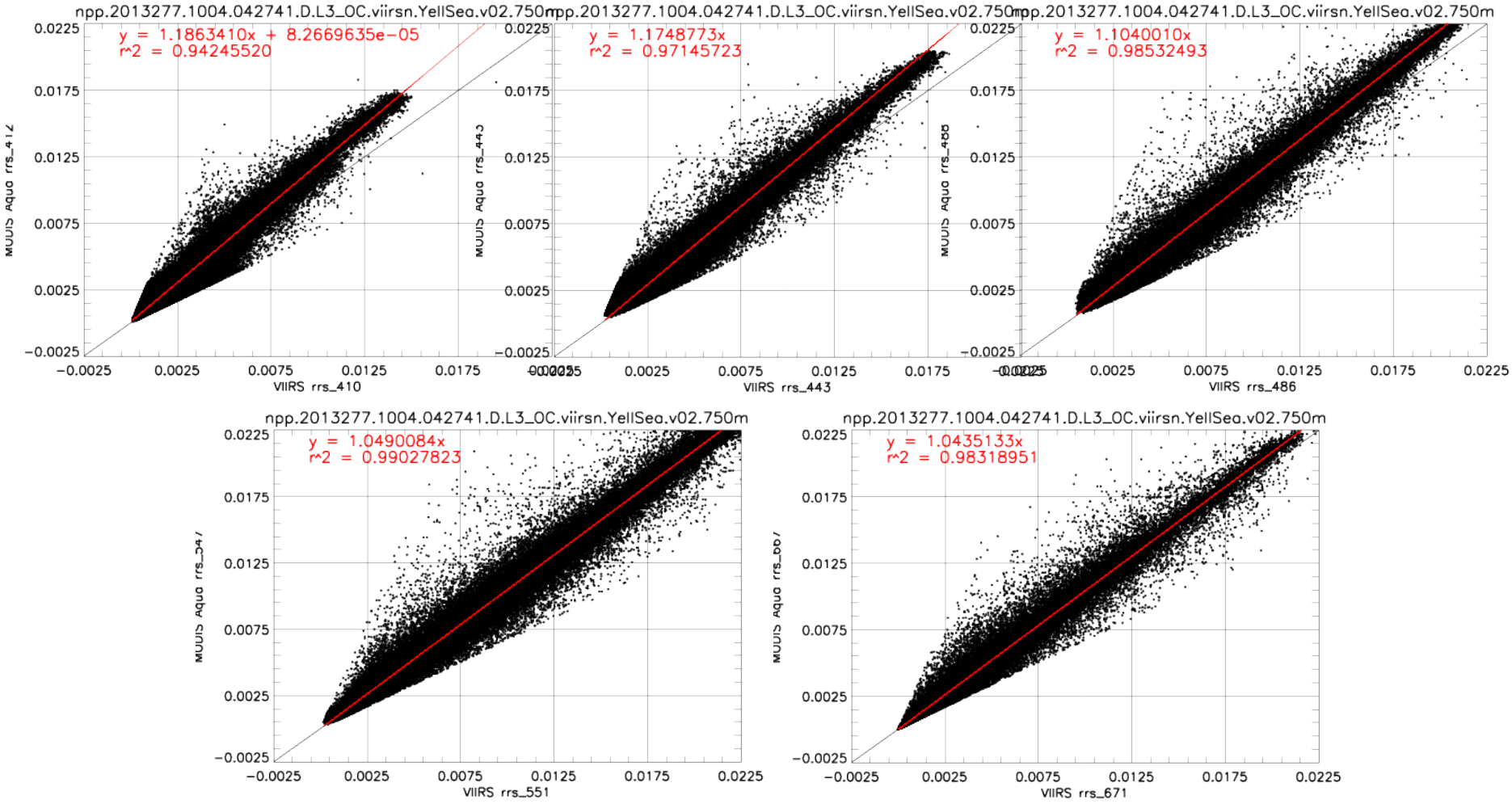
# Evaluation of GOCI, MODIS, and VIIRS Imagery

# JD 277 MODIS – GOCI Image Comparison



# Evaluation of GOCI, MODIS, and VIIRS Imagery

# JD 277 MODIS – VIIRS Image Comparison



# JD 277 Full Image comparison to sites from multiple images - $R^2$ Values

| $R^2$ Values | Multiple Images, Single Sample | | Single Image, all samples | |
|---|---|---|---|---|
| Channel | GOCI-MODIS | VIIRS-MODIS | GOCI-MODIS | VIIRS-MODIS |
| 412 | 0.539 | 0.970 | 0.842 | 0.942 |
| 443 | 0.835 | 0.993 | 0.943 | 0.971 |
| 490 | 0.930 | 0.992 | 0.976 | 0.985 |
| 555 | 0.980 | 0.979 | 0.983 | 0.990 |
| 690 | 0.959 | 0.914 | 0.972 | 0.983 |

**ed to MODIS, VIIRS doing a little better overall than GOCI (mair**
**e sensors consistent.**

# Conclusions

- MODIS, VIIRS, and GOCI remote sensing reflectances compare favorably in the East China Sea
- Application of Gains to GOCI and VIIRS visibly improves data
- Application of Gains lowers rrs in most cases
  - GOCI 412 and 443 channels appear to be exceptions
- Data from single points and imagery show similar statistics, except at GOCI 412 and 443 Channels
- Overall, the comparison between the sensors are good

# Future Efforts

- Investigate application of green-water gains for VIIRS and MODIS
- Attempt to acquire more in-situ data and re-analyze the rrs data
- Analyze the Inherent Optical Properties.